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The Feeding of Minerals to Cattle and Pigs—Field Experiments, 1927—The Nature of certain "Rogues" found among crops of Swede Turnips in Ireland—Sugar Beet Experiments, 1927—Comparative Agronomic Values of Red and White Clovers of Different Origin—Soil Acidity considered from the point of view of Base Exchange and Hydrogen Ion Concentration—Notes and Memoranda—Statistical Tables.

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THE FEEDING OF MINERALS TO CATTLE AND PIGS.

By J. P. Drew, M.Sc., *Professor of Agriculture, University College, Dublin, and* D. Deasy, B.Agr.Sc.

The progressive farmer is constantly on the alert for information and suggestions as to better methods of feeding his stock, and in recent years the question of the feeding of mineral matter is attracting his attention. The object of this paper is to summarize briefly some of the results of research work done in connection with the feeding of minerals to livestock.

It is now generally recognised that if the rations fed to farm animals are deficient in certain minerals the development of the young animal is retarded and the most economic returns either as regards meat production or milk yield fail to accrue.

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In the composition of the animal body there [illegible] ients, and the animal cannot develop normally unless [illegible] food. The mineral content of farm crops is somewhat [illegible] nimal body, consequently animals fed on these crops [illegible] nents but not always in the correct proportions.

The results of investigations show that there are at least four or five mineral-forming elements in which a ration may be deficient, namely :—calcium, phosphorus, sodium, chlorine and iron, and in some extreme cases iodine. Two of these elements, namely calcium and phosphorus, are certainly of importance because they constitute 90 per cent. of the mineral matter in the animal body and 50 per cent. of that in milk.

Until quite recently food stuffs were valued for the proteins, oils and carbohydrates they contained, no account being taken of the mineral constituents except in the determination of the manurial values of the unassimilated residue.

In later years, however, research workers in different parts of the world have been giving increased attention to the investigation of the relative nutritional values of food constituents. The results of these investigations have afforded a clearer conception of the importance of the mineral elements, and have demonstrated that the proportion of such elements in a food ration is worthy of more serious consideration than has been hitherto paid to it.

It should always be borne in mind that if the best results are to be obtained from the efforts being made for the improvement in the breeding of live stock, these must be accompanied by better methods of feeding, because a greater demand arises for nutrients, including minerals, in rations, in order to keep pace with the earlier maturity in beef cattle, and in pigs, and the production of higher milk yields by dairy cows.

DAIRY COWS.

The demand for mineral matter is considerable during each of the two periods throughout the life of a normal dairy cow, namely, the greater part

of the gestation period when the calf is being formed and during lactation. In the latter period the demand will vary with the amount of milk produced. The amount of mineral matter required for the growth of the foetus and for the production of milk may be derived either from the food given to the cow or from mineral matter already stored in the animal body, or it may be drawn from both these sources. For obvious reasons it is desirable that sufficient minerals should be available in the food supplied and that the store in the animal's body should be conserved.

It may be asked how dairy farmers in the past got on without any knowledge of mineral requirements. In this connection it must be remembered that farmers in those days were satisfied with a much lower milk yield than are their more progressive successors of to-day. With a milk yield of say three gallons, per day, it would be almost impossible to suggest any ration composed of food stuffs commonly in use that would not contain sufficient mineral matter for the cow's requirements. Usually it is only when yields of over four gallons of milk per day are attained that mineral deficiency may occur. It is by no means an uncommon occurrence for cows to give a high milk yield after calving and then after a short period to fall to much lower yields. In the light of increased knowledge as to the value of mineral matter, this reduction in the milk yield might be explained by the fact that the cow, having exhausted the reserve of mineral matter in her body, adjusts her milk yield to the mineral matter available in her ration alone. It has been stated that a cow giving 4 gallons of milk per day requires for maintenance and milk production a daily supply of $3\frac{1}{2}$ ozs. of calcium, more than $3\frac{1}{2}$ ozs. of phosphorus and over $\frac{1}{3}$ oz. of chlorine. In order, therefore, to maintain the high milk yields of dairy cows more attention must be paid to the mineral content of the foods fed, more especially during the winter months where cows are not allowed out on the pastures during the day. Orr (1) has shown that the grass consumed by a cow on an average pasture contains about three times as much calcium, sodium, and chlorine as does a winter ration of equal starch value composed of straw, turnips, distillers' grains and concentrates. Dairy cows are not, therefore, likely to suffer from mineral deficiency where grass forms a fair proportion of their diet.

While experiments have shown the importance of supplementing the rations of dairy cows deficient in mineral matter it has also been proved that the feeding of an excess of minerals may be distinctly harmful. Consequently care must be taken in supplementing rations that the correct minerals are supplied in a suitable form, and sufficient to meet the requirements of the animal, *i.e.*, for maintenance, for milk production and for the growth of the developing calf. It has already been indicated, that the most important mineral forming elements required by the dairy cow are calcium, phosphorus and chlorine. These can be suitably supplied in the forms of ground limestone, steamed bone flour and rock salt.

Supply of Mineral Matter in Feeding Stuffs.

The mineral composition of plants and those parts of plants which are usually used for feeding live stock varies with the nature of the soil on which

they are grown, the climatic conditions during growth and the stage of growth. Hence in the analysis of feeding stuffs a great variation in the amount and composition of the mineral matter present may reasonably be expected.

From analysis it is found that cereals are generally poor in calcium and chlorine. Indeed, Orr (2) states that 40 lb. of a mixture of oats, bran and maize in equal proportions would be required to supply ½ oz. of lime; these foods are, however, rich in phosphorus. Of the cereals—oats, wheat, barley and maize—oats is the most evenly balanced in mineral content. Meals and cakes vary in composition according to their source. They are generally poor in lime but rich in phosphorus. Fish meal made from the bones and soft tissues of fish is rich in mineral matter, principally calcium and phosphorus, but varies in its chlorine and iron content. Roots and tubers are low in mineral content, especially lime, and unless fed in very large quantities, do not supply any appreciable amount of minerals. On the other hand the fodders, hay, straw and silage, are rich in calcium, chlorine, and iron, though poor in phosphorus. From the foregoing it is evident that the mixing of grain and fodder in rations tends to correct the mineral deficiency in each.

Pastures have a very variable mineral content. Recent work carried out at the Rowett Institute, shows that the difference in feeding value of pastures is due not so much to variations in their protein and carbohydrate content as to the variable amounts of calcium and phosphorus present. Orr (2) states that there appears to be a casual relationship between the composition of the mineral matter of pastures and their feeding value. Thus an admixture of clover improves a pasture because this plant is rich in lime, containing as it does four times as much lime as phosphoric acid. On the other hand, cattle will not thrive on a purely clover ration because the amount of lime present in it is too high compared with the amount of phosphorus.

Seeing, therefore, that there is a great variation in the mineral content of the foods commonly used it is very difficult to construct a mineral mixture for general use in the feeding of dairy cows. Strictly speaking the mixture used should vary with the mineral composition of the particular feeding stuffs included in the ration. The following mineral mixture has, however, been used with success in a number of cases. It is simple to make up and is worthy of a trial in rations for cows whose milk yield exceeds 45 lb. (4½ gallons) per day :—

6	parts by weight	finely ground limestone, or ground chalk.
1	,, ,, ,,	steamed bone flour.
2	,, ,, ,,	agricultural salt.

The minerals should be mixed with the concentrated foods in the proportion of two pounds of minerals to each cwt. (112 lb.) of concentrates.

PIGS.

Experiments have shown that in breeding and feeding pigs the mineral content of the ration is of the utmost importance. In the case of the brood sow there is a considerable demand for mineral matter during gestation. A sow produces on the average sixteen bonhams per annum, and in order to do this requires a liberal supply of mineral matter to form the skeletons

of her young. There is a further demand after farrowing, as for the first three or four weeks the only source of mineral matter for the development of the bouhams is the sow's milk, and during this period the sow also needs sufficient mineral matter for her own requirements.

The feeding stuffs usually given to pigs, namely :—barley, pollard, maize and bran have a low mineral content. They are, as has already been indicated, particularly low in calcium. Pigs do not usually suffer from lack of phosphorus, as in most cases their food consists, at least in part, of cereal products which are rich in this mineral. Experiments, however, have shown that where phosphorus is lacking in a ration growth is retarded and paralysis of the hind legs occurs and that these conditions can be remedied in a short time by the addition to the food of minerals containing phosphorus.

Orr states that rapidly growing pigs also require considerable quantities of iron. In addition to the reserve store possessed at birth young pigs receive a more generous supply of iron in the milk of their dam than do most other animals. The percentage of iron in the sows's milk may be modified by the food fed to the animal. Furthermore it is quite probable that the reserve of iron in the young pig at birth may be affected by the feeding of the mother during gestation. Sows are often fed on foods containing very little iron, and in that event there is every likelihood that the young pigs may suffer from lack of this essential mineral at birth and during the suckling period.

The well known beneficial effect of feeding ashes to pigs, is due to the fact that the former contain minerals often deficient in the food. In this connection it might be added that wood ashes are rich in lime and coal ashes in iron. Pigs are frequently seen rooting up pastures and cattle droppings and it is now agreed that this habit is due to the natural craving of the pigs for mineral matter. The dung of herbivorous animals is rich in lime and iron. Pigs, particularly brood sows, should where practicable, be allowed free range over pastures, as in this way they will have an opportunity of supplementing the mineral matter deficient in their food.

In ordinary farm practice mineral deficiency is usually made up by the feeding of separated milk, which contains all the necessary minerals required by the growing animal. There is indeed little doubt that the beneficial effect of separated milk in the rearing and fattening of pigs is largely due to the mineral matter it contains. The deficiency of minerals may also be made up by the use of fish meal, which contains a high lime and phosphate content. Fish meal, however, unless judiciously fed has a deleterious effect on the quality of the bacon, and hence it is not generally regarded with favour as a pig food.

A deficiency of minerals in the ration of the brood sow results in the production of smaller litters, and in extreme cases the sow may fail to breed. In an experiment conducted by G. Baskett (3) on a herd of breeding pigs where the sows were given a ration deficient in mineral matter, the average number of pigs in a litter was only 6.6, and at weaning this number had dwindled to 2.7 ; while the survivors were weak and some of them suffered from a disease known as "Thumps" or "Blows." The addition of a mineral mixture to the ration resulted in a marked improvement ; the average litter

increased to 10.4, and the number alive at weaning averaged 7.1, the bonhams being perfectly normal.

Mineral matter is just as important for growing and fattening pigs as it is for the brood sow. Lack of mineral in the ration of such pigs is usually indicated by stiffness in the joints, by the development of rickets and by a general unthrifty appearance.

While it has been definitely shown that a ration may be substantially improved by the addition of mineral matter, still no mineral mixture has yet been devised that can satisfactorily replace separated milk. If separated milk is available it is not necessary to add minerals to the ration.

Experiment with minerals for pigs at Albert Agricultural College.

A test was carried out to see how far a ration was improved by the addition of a mineral mixture when no separated milk was available. The experiment was carried out as follows :—Thirty pigs, from sixteen to twenty weeks old, were selected and divided into two batches, each batch was then subdivided as evenly as possible into two lots, taking into consideration the age, weight and quality of the pigs.

All the pigs were then fed on the following mixture of meals, *ad lib.*, and the amount consumed recorded :—

10	parts by weight	of	maize meal.
5	,,	,,	pollard.
3	,,	,,	bran.
2	,,	,,	palm nut meal.

The pigs in lots 1 and 3 received minerals in their ration. The mineral mixture was made up by mixing the following :—

25	parts by	weight	steamed bone flour.
12	,,	,,	finely ground limestone.
7	,,	,,	rock salt (ground).
3	,,	,,	flowers of sulphur.
3	,,	,,	iron oxide.

The minerals included in the above mixture were purchased separately and mixed on the farm. The mixture cost 12s. 6d. per cwt., which was very little more than the cost of the meal mixture and the quantity used was 2 lb. per cwt. of meal mixture.

The food was prepared by adding water to the meal mixture until it was of a consistency suitable for pig feeding. The pigs were fed twice daily.

The pigs selected for the experiment, pure bred Large Irish Whites, were got by the same boar and were bred from closely related sows. The animals were, therefore, of uniform type and proved to be suitable in every way for experimental work.

After a period of nine weeks it was decided to allow each pig under experiment 1 oz. of cod liver oil per day in its food. The addition of the oil put the pigs off their food at first, but after a few days they took to it readily, and a marked increase in their appetites was noted. The inclusion of a small quantity of cod liver oil in rations for young pigs that are constantly housed and to which no separated milk or green foods are given, appears to be

beneficial and possibly aids in the assimilation of the mineral matter present in the ration. The results of the experiment are summarised in the following Table :—

GROUP	Number of Animals	Period of Experi-ment	Average Total Live Wt. increase per Pig	Average Daily Live Wt. increase per Pig	Total weight of meals consumed per Pig	Weight of meals required to produce 1lb. Live Wt. increase
		days	lb.	lb.	lb.	lb.
Lot 1 Minerals	7	112	141	1·26	663	4·70
Lot 2 No Minerals ...	7	112	133	1·19	690	5·20
Lot 3 Minerals	8	84	108	1·28	476	4·40
Lot 4 No Minerals ...	8	84	96	1·14	491	5·10

It will be observed from the foregoing table (*a*) that the pigs fed on a ration to which minerals had been added put up a greater average increase in live-weight ; and (*b*) that they required less of the total ration per lb. of live weight increase, than did the pigs which were fed on the meal mixture alone. The pigs in Lots 1 and 3 were more healthy and thrifty throughout the experiment than the pigs which had not been given minerals.

SUMMARY.

In the feeding and management of cattle as practised in this country, mineral deficiency in the food is most likely to occur in the case of milking cows that are entirely infed during the winter.

High yielding cows on pasture may require a supplementary mineral mixture. If such cows are receiving concentrated food, the mineral mixture referred to on p. 3 should be added to the concentrates.

Brood sows and fattening pigs which are not receiving an adequate quantity of separated milk, buttermilk or whey, and particularly if they have not access to pasture fields, should be given a supplementary mineral mixture.

When mineral mixtures are used in rations for young pigs it is advisable in cases in which green food is not available to include in the mixture a small quantity of cod liver oil.

Further investigations on the economic importance of the feeding of minerals to farm livestock are being conducted by Mr. E. J. Sheehy, B.Sc., who has recently been appointed lecturer in animal nutrition at the University College, Dublin.

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Jour. Scot., Board of Agric., Vol. 8.

(2) *Orr, J. B.*
Importance of Mineral Matter in Nutrition.

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The value of Mineral Supplements to Breeding Sows.
Jour. Ministry of Agric., N. Ireland, Vol. 1.

FIELD EXPERIMENTS, 1927.

The following Report deals with Field Experiments conducted in 1927. These experiments comprised trials with varieties of the various crops, experiments with phosphatic manures on meadow hay and turnips, top-dressing tests on pasture land, and experiments designed to test the value of lime when applied to a rotation of crops.

The detailed returns in respect of each test conducted by Agricultural Instructors may be found in the Annual Reports issued by the respective County Committees of Agriculture, and farmers and others interested are recommended to apply for a copy of the latter report to the Agricultural Instructor or to the Secretary of the County Committee of Agriculture for the County.

Information relative to the manuring of the various commonly grown farm crops, as ascertained from experiments already carried out by Agricultural Instructors, will be found in the Department's Leaflet No. 17.

I.—EXPERIMENTS WITH VARIETIES OF CROPS.

Wheat.

During the past season tests with Autumn or Winter sown varieties of wheat were conducted by Agricultural Instructors at 10 centres in 6 counties. The average yields per statute acre together with the average yields of grain obtained in the similar tests conducted in the previous year are shown in the following Table:—

Variety.	Average Yield per Statute Acre, 1927 (10 Centres).					Average Yield per Statute Acre, 1926 (20 Centres).	
	Grain.				Straw.	Grain.	
	C.	Q.	BRLS.	STS.	CWT.	C.	Q.
Yeoman	27	1	10	18	44	23	0
Yeoman II	27	0	10	16	44	24	1
Queen Wilhelmina	26	1	10	10	43	25	0
Square Head Master ...	25	0	10	0	44	23	1

Both Yeoman and Yeoman II. produced a heavier yield of grain than Queen Wilhelmina, which in the previous season's trials had proved superior in yielding capacity to both of these varieties.

Owing to the very wet summer, the past season was particularly favourable to the development of fungoid pests, and as Queen Wilhelmina is very susceptible to yellow rust, it is probable that the yield was reduced as a result of attacks of this pest. Both Yeoman and Yeoman II. possess strong, stiff straw and are capable of resisting lodging to a greater extent

than most other varieties of wheat in general cultivation in this country. These two varieties resemble each other very closely, but the quality of the flour produced by Yeoman II. has been found to be superior to that from Yeoman; hence the former variety is in greater demand.

Barley.

The experiments designed to determine the relative cropping powers of the two new selections from Spratt-Archer 37—viz., Spratt-Archer 37 No. 3 and Spratt-Archer 37 No. 4—as compared with the standard variety Spratt-Archer 37/6 conducted by the Agricultural Instructors during the seasons of 1925 and 1926, were repeated during the past season at 15 centres in 11 counties. The average yields of grain per statute acre together with the corresponding yields for the two previous seasons are shown in the following Table:—

Variety.	Average Yield of Grain per Statute Acre, 1927. (15 Centres.)				Average Yield of Grain per Statute Acre, 1926. (17 Centres.)		Average Yield of Grain per Statute Acre, 1925. (14 Centres.)	
	C.	Q.	BRLS.	STS.	C.	Q.	C.	Q.
Spratt-Archer 37 No. 4 ...	23	2	11	12	23	1	20	3
Spratt-Archer 37 No. 3 ...	23	0	11	8	23	0	20	3
Spratt-Archer 37/6 ...	22	2	11	4	22	3	20	0

As in the two previous years, Spratt-Archer 37 No. 4 and Spratt-Archer 37 No. 3 again proved slightly superior in yielding capacity to the standard variety Spratt-Archer 37/6, and, as in 1926, Spratt-Archer No. 4 produced a better yield of grain than Spratt-Archer No. 3. It was reported that all three varieties ripened about the same time and that none of the varieties included in the experiment showed any marked superiority over the others as regards resistance to lodging.

Oats.

As in the previous seasons, the oat varieties included in these trials were confined to pure line selections of the various varieties tested. All the varieties included in the tests, with the exception of Crown and Black Englebrect, which were obtained from the Swedish Plant Breeding Institute, Svalof, in the spring of 1925, were produced by the Department's Seed Propagation Division. The seed of each variety under test was obtained direct from the Department's Plant Breeding Station at Ballinacurra, Co. Cork.

The experiment was carried out with both black and white varieties, and the results from the two series are shown separately in the following Tables:—

(*a*) White Oats.

Tests with four varieties of white oats were conducted during the past season at 22 centres in 21 counties. The average yields of grain and straw

per statute acre and the corresponding yields of grain obtained in the similar tests conducted in 1926 are shown in the following Table:—

Variety.	Average Yield per Statute Acre, 1927. (24 Centres.)					Average Yield of Grain per Statute Acre, 1926. (28 Centres.)	
	Grain.				Straw.	Grain.	
	C.	Q.	BRLS.	STS.	CWT.	C.	Q.
Banner-Tartary 9 ...	24	1	13	12	37	25	0
Victory II	23	3	13	8	37	24	2
Crown	23	3	13	8	37	24	1
Victory	22	1	12	10	36	23	3

Banner Tartary 9 again produced the heaviest yield of grain. This variety, which was fully described in a previous report, produces a stiff straw, is very resistant to lodging and is particularly well suited for cultivation on the richer types of soils. It develops slowly in the early stages of growth, particularly on poor soils, and is somewhat late in ripening and, therefore, requires to be sown early.

Crown, which has rather long, weak straw, produces a plump grain of good quality and usually ripens earlier than Victory or Victory II.

Victory II again proved distinctly superior to Victory in yielding capacity.

(*b*) Black Oats.

Tests with four varieties of black oats were conducted during 1927 at 22 centres in 15 counties. The average yields obtained per statute acre as well as the corresponding yields of grain for such of the varieties as were included in similar tests conducted in 1925 and 1926 are shown in the following Table:—

Variety.	Average Yield per Statute Acre, 1927. (22 Centres.)					Average Yield of Grain per Statute Acre, 1926. (18 Centres.)		Average Yield of Grain per Statute Acre, 1925. (16 Centres.)	
	Grain.				Straw.	Grain.		Grain.	
	C.	Q.	BRLS.	STS.	CWT.	C.	Q.	C.	Q.
Black Englebrect ...	25	0	14	4	41	—		—	
Black Bell III ...	24	0	13	10	38	23	2	22	1
Black Tartary (a new selection No. 1) ...	24	0	13	10	38	23	2	21	3
Black Tartary (Department's Pure Line)...	23	1	13	4	37	22	3	20	1

Black Englebrect, which was included for the first time in these trials last season, possesses strong, stiff straw and ripens earlier than the other varieties included in the test. The grain is long and thin, but of good colour. However, it appears to be more susceptible to smut than Black

Tartary or Black Bell III. Black Tartary (a new selection No. 1), which very closely resembles Black Tartary, again proved superior in yielding capacity to the latter variety.

SUPPLIES OF PURE LINE SEED.

In connection with the Department's scheme for the distribution of pedigree seed oats amongst farmers' "extension" plots of some of the pure line strains included in the above tests have been grown at various centres during the past seven seasons under the supervision of the Department and the Agricultural Instructors, and considerable quantities of seed, particularly of Victory, Victory II, Black Tartary and Black Tartary (a new selection No. 1) are now available in some counties. Growers are recommended to ascertain from the Agricultural Instructor for their district where supplies of seed of these and other varieties may be obtained.

Potatoes.

In previous trials with varieties of potatoes conducted by Agricultural Instructors "seed" of the different varieties included in the experiments was procured locally by each Instructor. In the trials conducted in 1927 it was, however, arranged that "seed" for all experiments should be procured from one district, and as adequate supplies of certified seed of all the varieties included in the test were only obtainable in Co. Donegal, the necessary quantities of all four varieties were procured from that area. Tests were conducted at 56 centres in 26 counties, and the average yields obtained per statute acre are shown in the following Table:—

Variety.	Average Yield per Statute Acre, 1927 (56 Centres).							
	Saleable.		Small.		Diseased.		Total.	
	T.	C.	T.	C.	T.	C.	T.	C.
Kerr's Pink ...	13	7	1	8	–	2	14	17
Arran Consul ...	13	13	0	18	–	2	14	13
Up-to-Date ...	12	14	1	9	–	4	14	7
Old Champion ...	8	18	2	3	–	12	11	13

Arran Consul, which was put on the market in 1924, and was included for the first time in these trials in 1927, is an immune, maincrop, variety which produces somewhat irregularly-shaped, white-skinned, white-fleshed tubers with fairly shallow eyes. The haulm, which is upright, develops slowly in the early part of the year, but grows vigorously later in the season. The flowers are white but are only occasionally produced. In the trials conducted during the past season Arran Consul produced practically the same yield as the standard varieties, Kerr's Pink and Up-to-Date, and proved distinctly superior in yielding capacity to Old Champion. From the reports received from the various centres it would appear that Arran Consul is somewhat inferior to Kerr's Pink in cooking quality.

Root Variety Trials.

In the summer of 1926 the Department were asked by the Irish Seed and Nursery Traders' Association to include in the trials to be conducted by the Agricultural Instructors during the season of 1927 varieties of roots offered for sale by members of the Association. The Department agreed to include in the tests, in addition to those varieties which had been found to have given satisfactory yields in previous trials, varieties of mangels and swedes, not exceeding six of each in number, offered for sale by members of the Association, which, if they gave favourable results, would be so distinctly named and standardised that farmers would have no difficulty in procuring supplies of them. As the Irish Seed and Nursery Traders' Association did not furnish the names of any varieties of mangels and swedes, the Department notified the Agricultural Instructors to include in the variety trials with mangels and swedes in addition to the four varieties of each which had given satisfactory yields in the previous season's tests, such varieties of mangels or swedes supplied by Dublin, Cork, Limerick, Waterford or other local seedsmen, as were proprietary to such firms and which could be regarded as distinct and likely to produce good yields.

Mangels.

Tests were conducted at 59 centres in 24 counties. The varieties included in the similar tests conducted during the previous year, and which had given satisfactory results, namely, Yellow Globe, Red Intermediate, Lord Warden and White Knight, were sown at all centres. In addition, the following varieties supplied by Irish seedsmen were included—Fulcrop (Rowan), 34 centres; Monarch (Powers) at 12 centres; Lord Edward (I.A.W.S.) at 3 centres, and Abundance (Dicksons) at 1 centre. The yields obtained from the different varieties included at each centre and the average yield from 34 centres where five varieties were included are shown in Table I.

As in the previous season, Yellow Globe, Red Intermediate and Lord Warden again maintained their position as heavy-yielding varieties.

Swedes.

Tests were conducted at 57 centres in 23 counties. At 47 of these centres the four varieties which had given the best results in the previous season's trials, namely, Magnificent, Tipperary, Up-to-Date and Caledonian, were sown. In addition, the following varieties supplied by Irish seedsmen were included: Fulcrop (Rowan), at 35 centres; Colossal (Powers), at 12 centres; Triumph (Hogg & Robertson), at 7 centres, and Abundance (Dicksons) at 2 centres. The yield produced by the different varieties included at each centre, and the average yield per statute acre from 31 centres where 5 varieties were included, are shown in Table II.

[Tables I. & II.

TABLE I.—MANGEL VARIETY TESTS, 1927.

County.	Character of Soil.	Yellow Globe	Red Intermediate	White Knight	Lord Warden	Fulcrop Yellow Globe	Monarch	Lord Edward	Abundance
		T. C.	T. C.	T. C.	T. C.	T. C.	T. C.	T. C.	T. C.
Cavan	Heavy loam	22 19	22 12	22 19	18 18	22 10	—	—	—
Carlow	Loam	21 13	23 16	19 4	21 8	—	—	—	—
,, ...	,, ...	22 12	24 7	21 10	21 18	—	—	—	—
Clare	Peaty	32 3	25 9	28 6	34 6	28 11	—	—	—
,, ...	Light loam overlying heavy clay	18 13	19 9	26 18	31 11	—	—	—	—
Cork	Clay loam	31 5	35 18	33 4	27 13	31 1	33 2	—	—
,, ...	Medium loam	28 2	31 3	26 11	25 17	28 11	32 2	—	—
,, ...	Heavy clay loam	28 4	29 1	23 14	26 11	28 8	26 13	—	—
,, ...	Medium sandstone loam ...	28 11	26 13	22 17	27 14	23 6	27 2	—	26 7
,, ...	Medium loam	27 16	35 17	25 10	29 6	—	29 3	—	—
,, ...	Dark loam	23 13	23 0	21 4	19 6	—	23 4	—	—
,, ...	Light deep loam	38 4	41 16	37 10	37 4	—	42 11	—	—
,, ...	Dark loam	26 5	28 16	26 7	27 1	20 14	23 2	—	—
,, ...	Sandy loam	24 15	24 19	20 11	23 19	21 7	20 2	—	—
,, ...	Light loam	20 16	22 11	21 12	19 18	20 1	22 11	—	—
,, ...	Medium clay loam	28 10	36 4	31 16	28 7	25 8	31 10	—	—
,, ...	Heavy loam	24 17	29 10	24 6	24 8	—	27 13	—	—
Dublin	Clay loam	29 19	30 0	27 15	27 10	—	—	24 5	—
,, ...	Loam	33 4	34 12	31 4	38 9	—	—	35 11	—
,, ...	Clay	22 14	30 2	22 3	24 4	—	—	20 9	—
Galway	Strong limestone loam ...	27 2	30 10	28 0	29 15	—	—	—	—
,, ...	Loam (slightly moory) ...	25 7	27 14	23 10	24 17	—	—	—	—
Kerry	Medium loam	37 9	40 2	37 2	40 14	—	—	—	—
,, ...	,, ,, ...	30 6	26 14	29 3	33 3	—	—	—	—
,, ...	Strong loam	37 13	41 3	40 8	39 16	—	—	—	—
,, ...	,, ,, ...	43 4	49 18	43 4	44 10	—	—	—	—
,, ...	Medium loam	42 0	44 2	43 14	43 11	—	—	—	—
Kildare	Deep loam	31 3	30 7	29 6	33 10	30 0	—	—	—

,, ...	Sandy loam	26 5	25 3	24 9	27 10	26 4	—	—	—
,, ...	Loam	27 15	24 15	24 18	28 16	27 18	—	—	—
Kilkenny	Medium moory	29 0	28 8	31 16	30 3	30 9	—	—	—
,, ...	Medium loam	32 0	30 9	29 0	29 14	—	—	—	—
,, ...	,, ,, ...	38 9	37 0	37 15	44 0	39 3	—	—	—
Leitrim	Rich peaty soil	30 5	26 4	25 10	26 18	27 3	—	—	—
Limerick	Heavy loam	30 14	35 14	31 16	31 3	32 10	—	—	—
,, ...	Light limestone loam ...	34 8	38 0	36 0	42 0	36 14	—	—	—
,, ...	Clay loam	30 5	41 15	37 3	46 0	—	—	—	—
,, ...	Limestone loam	28 0	34 6	35 9	32 0	—	—	—	—
Longford	Heavy loam	29 0	32 0	28 10	29 15	26 10	—	—	—
Mayo	Medium loam	19 3	22 0	19 0	23 0	22 10	—	—	—
,, ...	Clay loam	24 2	24 0	23 2	26 3	—	—	—	—
Meath	Clay loam	37 6	37 10	34 12	39 16	37 4	—	—	—
,, ...	Gravelly loam	35 6	28 19	28 6	31 4	33 17	—	—	—
Offaly	Strong clay loam	20 10	19 5	20 17	20 8	20 12	—	—	—
Roscommon ...	Medium dark loam	41 11	37 4	40 1	43 3	—	—	—	—
Sligo	Moory loam	29 12	30 6	27 18	32 15	28 4	—	—	—
Tipperary, N.R. ...	Clay loam	27 16	28 2	28 2	27 10	—	—	—	—
,, ...	Rich clay loam	28 6	28 17	24 11	28 3	—	—	—	—
Tipperary, S.R. ...	Medium clay	27 12	33 3	37 3	32 6	25 0	—	—	—
,, ...	Medium clay	34 17	30 0	27 12	28 3	32 14	—	—	—
Donegal	Stiff clay	29 12	30 0	25 2	26 3	24 3	—	—	—
Waterford ...	Limestone loam	25 10	22 9	21 8	25 9	26 13	—	—	—
Westmeath ...	Peaty loam	28 2	24 6	26 19	24 16	—	—	—	—
Wexford	Sandy loam	34 15	38 2	38 3	33 10	32 10	—	—	—
,, ...	Shingly loam	39 12	47 5	45 5	41 5	36 15	—	—	—
Wicklow	Medium loam	37 12	36 6	33 5	32 8	37 16	—	—	—
,, ...	,, ,, ...	35 4	29 2	31 13	31 14	35 1	—	—	—
,, ...	,, heavy loam ...	29 16	28 13	27 16	29 6	28 15	—	—	—
Sligo	—	26 2	30 1	21 5	25 14	25 3	—	—	—
Average Yield per Statute Acre (5 varieties, 34 centres)		31 16	30 3	28 9	29 12	28 17	—	—	—

TABLE II.—SWEDE VARIETY TRIALS, 1927.

County.	Character of Soil.	Magnificent	Tipperary	Up-to-date	Caledonian	Fulcrop	Colossal	Triumph	Abundance
		T. C.	T. C.	T. C.	T. C.	T. C.	T. C.	T. C.	T. C.
Carlow	Loam	18 10	22 2	22 19	22 14	—	—	—	—
Cavan	Deep loam	29 9	28 0	20 12	27 3	28 18	—	—	—
„	Friable loam	27 9	25 15	22 6	19 6	24 18	—	—	—
Clare	Medium loam	10 0	10 9	8 14	11 17	—	—	—	—
„	Heavy loam	—	34 8	33 18	34 11	30 14	33 11	29 14	—
Cork (N.E.) ...	Medium	28 5	34 13	24 0	30 7	25 0	26 6	—	—
Cork (S.E.) ...	Medium sandy loam ...	17 15	22 3	17 13	17 15	15 8	16 18	—	17 12
„ ...	„ „ ...	22 10	26 2	25 0	23 18	23 17	21 18	—	23 14
Cork	Light loam	20 11	22 3	20 7	20 12	—	—	—	—
„	Medium loam	23 0	25 10	26 18	25 17	—	32 18	—	—
„	Light loam	31 4	32 6	26 17	25 17	—	31 7	—	—
„	Sandy loam	21 11	24 17	26 18	24 6	24 12	23 8	—	—
„	Light loam	19 12	21 18	22 15	21 18	23 11	22 2	—	—
„	Limestone loam	33 16	38 1	36 4	21 19	32 10	31 4	—	—
Donegal	Rich loam	27 5	29 9	27 11	22 0	24 18	—	—	—
Dublin	Clay loam	20 4	20 4	19 11	19 10	18 8	—	18 0	—
„	„ „	13 9	14 11	14 9	13 7	10 13	—	12 0	—
Kerry	Loam	34 3	35 10	32 14	30 14	—	—	—	—
„	Medium loam	34 6	33 6	32 17	30 3	—	—	—	—
„	„ „	27 14	24 14	27 11	25 9	—	—	—	—
„	Strong loam	27 16	33 7	29 11	28 15	—	—	—	—
„	Deep gravelly loam ...	35 3	32 3	27 3	28 0	—	—	—	—
Kildare	Light loam	29 11	29 12	29 4	28 10	27 0	—	—	—
„	Deep loam	30 3	30 12	26 14	30 16	29 16	—	—	—

Kilkenny ...	Medium loam	26 0	26 9	26 9	22 11	27 3	27 17	—	—
,, ...	Heavy loam	20 4	22 0	27 6	18 6	20 9	20 0	—	—
Leitrim	Loam	27 10	26 5	26 3	25 14	28 0	—	—	—
Limerick ...	Medium lime loam	43 5	40 0	36 0	36 10	37 10	31 5	—	—
,, E. ...	Gravelly loam	22 6	26 0	19 5	20 6	—	—	—	—
,, ,, ...	Clay loam	24 18	22 6	22 18	18 12	—	—	—	—
Mayo	Clay loam	24 8	24 12	23 15	23 6	—	—	—	—
,, ...	Good	27 0	27 0	27 10	28 0	27 0	—	—	—
Meath	Sharp loam	34 6	30 16	32 2	37 3	34 16	—	—	—
Monaghan ...	Good medium loam	—	25 3	25 6	27 14	22 11	—	22 3	—
,, ...	Rich medium loam	—	24 0	30 0	32 0	30 0	—	27 0	—
Offaly	Sandy loam	26 0	26 5	23 16	25 0	23 2	—	21 10	—
,, ...	Strong clay	—	27 5	22 8	26 12	22 4	—	22 12	—
Roscommon ...	Light medium loam	33 9	32 1	28 11	27 19	—	—	—	—
Sligo	Medium loam	32 11	29 3	30 6	31 8	32 17	—	—	—
,, ...	,, ,, ...	22 0	28 17	21 3	24 1	25 3	—	—	—
Tipperary, N.R. ...	Strong clay	19 16	20 17	21 13	17 19	20 17	—	—	—
,, ...	Clay loam	21 17	18 13	18 13	16 4	18 17	—	—	—
Tipperary, S.R. ...	Medium clay	28 3	28 6	30 0	26 12	26 12	—	—	—
,, ...	,, ,, ...	31 4	30 10	26 12	24 16	26 18	—	—	—
Waterford ...	Deep loam	32 13	30 19	29 10	24 2	27 8	—	—	—
,, ...	Strong sandstone loam ...	28 12	29 3	25 18	22 15	25 18	—	—	—
Westmeath ...	Medium loam	30 2	23 1	20 3	26 15	—	—	—	—
,,	,, ,, ...	27 3	25 12	22 3	26 3	—	—	—	—
Wexford ...	Loam	27 6	29 5	20 10	19 15	23 5	—	—	—
,, ...	Shingly loam	25 5	26 7	26 0	22 15	24 2	—	—	—
Wicklow ...	Medium loam	24 4	23 10	23 8	21 14	24 4	—	—	—
Average Yield per Statute Acre (31 centres, 5 varieties)		26 9	27 2	25 7	24 1	25 5	—	—	—

Both Tipperary and Magnificent, which have consistently given good returns in these trials for a number of seasons, again maintained their capacity for the production of heavy yields.

Grass Seed Mixtures.

The following mixture of grass and clover seeds was for some years widely used for the laying down of land to pasture for four years and upwards, and in general it gave satisfactory results:—

15 lbs. Perennial Rye Grass
7 ,, Italian Rye Grass
4 ,, Meadow Fescue
3 ,, Timothy
3 ,, Cocksfoot
2 ,, Broad Red Clover
2 ,, Late Flowering Clover
1 ,, Alsike Clover
1 ,, White Clover

It has, however, been put forward that Italian Rye Grass exercises an injurious influence on the clovers and finer grasses, and that better results could be obtained where it was excluded from the mixture and the Cocksfoot proportionately increased. It has also been held that Meadow Fescue is not sufficiently productive to justify its inclusion in a mixture of grass and clover seeds when a fair proportion of Cocksfoot is sown. It was, therefore, decided that a mixture as set out above should be compared with a similar mixture, except that the Italian Rye Grass and Meadow Fescue should be omitted and an additional quantity of Cocksfoot included. The following mixture was accordingly decided upon as suitable for comparison:—

15 lbs. Perennial Rye Grass
3 ,, Timothy
9 ,, Cocksfoot
2 ,, Broad Red Clover
2 ,, Late Flowering Clover
1 ,, Alsike Clover
1 ,, White Clover

The experiment was conducted at 37 centres in 22 counties. The two mixtures were sown side by side with a cereal as a nurse crop in the Spring of 1926, and the yield of hay on both plots was determined in the Summer of 1927. From reports received from the Instructors it would appear that in the early part of the season the plot sown with the mixture containing Italian Rye Grass was the more forward of the two, and from a few centres it was reported that more clover was to be seen in the plot in which Italian Rye Grass was not sown. The yields of hay per statute

acre obtained from the two plots at all centres at which the experiment was conducted, as well as the average yields, are shown in Table III.

TABLE III.

County.	Nature of Soil.	Yield per Statute Acre. Plot I. (Mixture containing Italian Rye Grass).			Plot II. (Mixture in which Italian Rye Grass was not included).		
		T.	C.	Q.	T.	C.	Q.
Carlow ...	Loam	1	17	0	1	15	2
,, ...	,, ...	2	6	3	2	3	1
Cavan ...	Strong loam ...	2	10	0	2	0	0
,, ...	Sandy loam ...	2	1	3	1	19	0
Clare ...	Medium loam ...	2	2	1	2	5	0
,, ...	Light loam ...	1	18	2	2	1	2
Cork ...	Medium loam ...	1	18	2	1	19	0
,, ...	Heavy sandstone loam	1	5	2	1	3	3
,, ...	Sandy loam ...	2	1	0	2	6	1
Donegal ...	Deep medium loam ...	1	19	0	1	16	2
,, ...	Light loam ...	1	12	1	1	11	2
Dublin ...	Clay loam	2	10	2	2	8	2
,, ...	Sandy loam ...	1	6	0	1	7	1
Galway ...	—	2	1	0	1	18	0
Kildare ...	Loam	1	18	3	1	14	2
,, ...	Sandy loam ...	1	16	3	1	13	2
Kilkenny ...	Clay loam	2	13	0	2	15	2
Laoighis ...	Light loam ...	2	3	0	2	1	0
,, ...	Clay loam	3	0	0	2	15	0
,, ...	Light loose loam ...	2	15	0	3	1	0
,, ...	Light clay loam ...	2	12	0	2	18	0
Leitrim ...	Stiff clay	1	18	2	1	16	1
Longford ...	Medium clay ...	3	4	0	3	0	0
Mayo ...	Loamy clay ...	1	12	2	1	11	0
,, ...	Medium loam ...	2	4	1	2	1	0
Meath ...	Clay loam	2	10	0	2	3	2
,, ...	Clay loam	2	3	0	2	1	1
Offaly ...	Strong loam ...	2	8	0	1	15	2
Roscommon ...	Heavy limestone clay soil.	1	11	3	1	12	1
Sligo ...	Moory soil	1	8	3	1	5	1
Tipperary, S.R.	Heavy clay ...	2	2	2	2	12	2
,, N.R.	Clay loam	2	16	0	2	19	0
Westmeath ...	Heavy loam ...	3	0	1	2	14	1
,, ...	Medium loam ...	3	2	2	2	17	3
Wexford ...	Heavy clay ...	2	18	0	3	5	0
Wicklow ...	Medium loam ...	2	4	2	2	1	0
,, ...	Heavy loam ...	3	6	0	3	1	0
Average Yield per Statute Acre (37 centres)		2	4	3	2	3	2

Although the average yield per statute acre in favour of the plot sown with the mixture in which Italian Rye Grass was included is only 1¼ cwt., it will be observed that at 25 out of the 37 centres at which the tests were conducted it gave the better return. It is therefore evident that, in the first season at least, Cocksfoot, even when included in a mixture to the extent of 9 pounds per statute acre, is not capable of producing the same bulk of hay as a mixture in which Italian Rye Grass and Meadow Fescue are included together with a small quantity of Cocksfoot. The plots are being kept under observation with the object of comparing the pasture produced by the two mixtures of seeds in the subsequent seasons.

II.—EXPERIMENTS WITH PHOSPHATIC MANURES.

During the season of 1926 experiments on the turnip crop were conducted by Agricultural Instructors to compare the relative effects of Superphosphate, Semsol, Gafsa mineral phosphate, Ephos phosphate and Clare phosphate. The experiment comprised two series—(a) one in which the phosphates were used to supplement a dressing of farmyard manure, and (b) one in which the phosphates were applied in addition to sulphate of ammonia and kainit. The results of these trials were published in the Department's JOURNAL, Vol. XXVI., No. 4.

It was decided to repeat these experiments on exactly similar lines in 1927, and also to conduct trials on meadow hay with similar phosphatic manures, except that 4 cwt. of Basic Slag per statute acre should be used as the basic dressing instead of superphosphate.

As in previous years, all the phosphatic manures were assembled by the Department at one centre from which, after analysis, the requisite quantity of each manure was despatched to the Agricultural Instructors.

Particulars as to the composition, solubility, etc., of the phosphatic manures included in the experiments are shown in the following Table:—

Manure	Total Phosphates	Water Soluble Phosphates	Citric Soluble Phosphates	Proportion of Total Phosphate soluble in Citric Acid	Fineness 100-mesh Sieve
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Superphosphate	36·64	36·22	—	—	—
Semsol ...	45·13	17·41	30·09	66·6	—
Gafsa Mineral Phosphate ...	56·69	—	21·17	37·3	89·9
Clare Phosphate	58·78	—	5·29	9·0	92·9
Ephos Phosphate	59·20	—	22·01	37·2	85·1
Basic Slag ...	42·21	—	38·87	92·1	78·6

Experiments on the Turnip Crop.

(*a*) WITH FARMYARD MANURE.

All plots were dressed with farmyard manure at the rate of 15 tons per statute acre. Plot 2 received in addition an application of superphosphate

at the rate of 4 cwt. per acre, while the other plots, with the exception of plot (1) which was reserved as a control, received equivalent quantities of total phosphates derived from Semsol, Gafsa mineral phosphate, Ephos phosphate and Clare phosphate respectively.

Tests were conducted at 34 centres in 25 counties, and the average returns per statute acre, together with the similar returns obtained in the previous season's trials are shown in the following Table:—

Phosphatic Manures applied per Statute Acre.		Average Yield per Statute Acre, 1927. (34 Centres).		Average Yield per Statute Acre, 1926. (17 Centres).	
		T.	C.	T.	C.
No Phosphates ...	... ...	21	2	21	4
Superphosphate	448 lbs. = 4 cwt. ...	26	14	24	19
Semsol	364 ,, = $3\frac{1}{4}$,, approx.	25	19	24	10
Gafsa Mineral Phosphate	290 ,, = $2\frac{3}{5}$,, ,,	25	7	24	6
Ephos Phosphate	277 ,, = $2\frac{1}{2}$,, ,,	24	12	23	14
Clare Phosphate	279 ,, = $2\frac{1}{2}$,, ,,	23	8	23	7

(*b*) Without Farmyard Manure.

In this series all plots received a dressing of 1 cwt. sulphate of ammonia and 3 cwt. kainit per statute acre. One plot at each centre, which served as a control, received no additional manuring; a second plot received a dressing of superphosphate at the rate of 4 cwt. per statute acre, and each of the subsequent plots received equivalent quantities of total phosphates, derived from Semsol, Gafsa mineral phosphate, Ephos phosphate, and Clare phosphate, respectively.

Trials were conducted at 30 centres in 19 counties, and the average returns per statute acre, together with the corresponding returns obtained in the trials conducted in 1926, are shown in the following Table:—

Phosphatic Manures applied per Statute Acre.		Average Yield per Statute Acre 1927. (30 Centres).		Average Yield per Statute Acre 1926. (20 Centres).	
		T.	C.	T.	C.
No Phosphates ...	... ...	10	15	11	9
Superphosphate	448 lbs. = 4 cwt. ...	24	8	21	19
Semsol	364 ,, = $3\frac{1}{4}$,, approx.	23	4	21	10
Gafsa Mineral Phosphate	290 ,, = $2\frac{3}{5}$,, ,,	22	7	20	9
Ephos Phosphate	277 ,, = $2\frac{1}{2}$,, ,,	21	11	19	8
Clare Phosphate	279 ,, = $2\frac{1}{2}$,, ,,	14	16	15	8

The results produced in both series of experiments conducted during 1927 are in close agreement with those obtained in the previous season's

trials. Whilst the highest average yields were again produced where superphosphate was applied, the increased yield as compared with that obtained where Semsol was used is comparatively slight, more particularly as the quantity of the latter applied per acre was only $3\frac{1}{4}$-cwt. as compared with 4 cwt. of superphosphate. Gafsa mineral phosphate, although somewhat inferior to Semsol, again proved superior in both series of experiments to Ephos and Clare phosphate. When it is taken into consideration that Gafsa can be purchased at a cheaper rate than Semsol, and that in these experiments the quantity applied per statute acre was only $2\frac{5}{8}$ cwts., approximately, as compared with $3\frac{1}{4}$ cwt. of Semsol, it is doubtful if Gafsa under average conditions is not a more economical source of phosphates for the turnip crop than either Semsol or Superphosphate. Ephos phosphate again gave a lower average yield than Gafsa mineral phosphate, and as it is selling at a higher rate than Gafsa, its use cannot be recommended. Whilst the Clare phosphate supplied for the past season's trials was similar in composition to that provided in 1926, it was in much finer condition—the percentage of fineness being 92·9% as compared with 54·1% in the previous year. Relatively better returns were obtained from Clare phosphate in the series of experiments where farmyard manure was applied than where artificial manures only were used, but in both series, and particularly in the latter, the results compare unfavourably with those produced by any of the other phosphates.

Experiments on Meadow Hay.

As in the previous experiments conducted with phosphatic manures on meadow hay, high grade basic slag at the rate of 4 cwt. per statute acre was used as the standard for comparison with equivalent quantities of total phosphates derived from Semsol, Gafsa mineral phosphate, Ephos phosphate and Clare phosphate. Apart from the phosphates no additional manures were applied at any centre.

Tests were conducted at 29 centres in 20 counties, and the average results obtained are shown in the following Table:—

Phosphatic Manures applied per Statute Acre.	Average Yield per Statute Acre, 1927. (29 Centres). C.	Q.
No Phosphate	36	0
Basic Slag ... ... 448 lb.=4 cwt. ...	43	0
Semsol ... ... 419 „ $=3\frac{3}{4}$ „ approx.	45	0
Gafsa Mineral Phosphate 334 „ =3 „ „	41	0
Ephos Phosphate ... 319 „ $=2\frac{7}{8}$ „ „	42	0
Clare Phosphate ... 322 „ $=2\frac{7}{8}$ „ „	40	0

The experiment was at each centre conducted on land which had been grazed or meadowed for a long period and which had not been dressed with phosphatic or other manures during recent years. The manures were at almost all centres applied during the month of March, but, probably owing to the unfavourable weather during the Spring, little results were noticeable until late in the month of May, when the plots dressed with Basic Slag and Semsol showed a distinct improvement in appearance as compared with the other plots. Later in the season, however, there was no very marked difference in the general appearance of the plots to which the phosphates had been applied, except that there was a better development of clovers in the plots which had received a dressing of Basic Slag. The average returns, as shown above, are distinctly in favour of Semsol. Basic Slag, while not so effective as Semsol, has proved superior to the other phosphates applied, not alone as regards increase in yield of hay, but also in respect of the development of better quality grasses and clovers. The returns from Gafsa mineral phosphate, Ephos phosphate and Clare phosphate are practically equal. It was, however, observed at a few centres that a greater quantity of clover developed on the plot dressed with Gafsa than on the plots to which Ephos and Clare phosphates had been applied. It is proposed that the plots should be kept under observation with a view to determining the relative effects of the different phosphates in the second and subsequent seasons.

III.—Top-dressing Tests on Pasture.

During the three seasons 1922-24 a series of demonstrations on pasture with Basic Slag, Peerless, Gafsa and Algerian mineral phosphates were laid down by Assistant Agricultural Overseers at 138 centres. The manures were applied at all centres at the rate of 8 cwt. per statute acre and the demonstrations were in general confined to the poorer types of pastures which had not received a dressing of manures within recent years. In the first season each of the phosphatic manures applied produced a marked improvement in the pasture, not only as regards the increased growth of grass, but also in the development of the clovers. It was noticed, however, that the earliest response and the best results were obtained where Basic Slag and Peerless had been applied. The plots have been inspected periodically each season since and the results have been noted each year in these reports. The returns obtained during the second and third seasons were in close agreement with those produced in the year in which the phosphates were applied. At the end of the third season, however, it became evident that Peerless, which in the earlier years had given returns at least equal to those obtained where Basic Slag was applied, was becoming less effective, and that Gafsa and Algerian mineral phosphates were producing a greater improvement in the pasture than was observed in the season in which they were applied. In the fourth season following that in which the phosphates were applied a similar tendency was noticeable, Peerless in that season producing returns inferior to those obtained from the mineral

phosphates, while Basic Slag, at a number of centres, proved but slightly superior to Gafsa and Algerian phosphates.

Reports received towards the end of the season 1927 on the plots laid down in 1922 and 1923 show that during the past season at the majority of the centres the best returns were produced where Gafsa and Algerian mineral phosphates had been applied. At a few centres Basic Slag maintained its superiority over the mineral phosphates, but even at these centres the difference in favour of the Basic Slag was relatively slight. Peerless appears to have been even less effective than in the previous year, and it is evident that the influence of this manure on pasture does not extend much beyond the fifth or sixth season. On the other hand, Gafsa and Algerian mineral phosphates appear to be capable of producing better returns than Basic Slag in the fifth season following that of application. It must, however, be borne in mind that all the manures were applied in similar quantities, and therefore that the plots to which Gafsa and Algerian mineral phosphates were applied received a greater amount of total phosphates than the plots dressed with Peerless or Basic Slag. Mineral phosphates of the Gafsa and Algerian types can, however, in most districts, be purchased, weight for weight, at a cheaper rate than either Peerless or Basic Slag, and, therefore, farmers who propose to apply phosphates to pasture land need have no hesitancy about using mineral phosphates of the Gafsa and Algerian type as a substitute for basic slag.

With the object of comparing the relative effects on pasture of top-dressings of Semsol, Clare phosphate and M'Dilla mineral phosphate a series of plots dressed with these manures, at the rate of 8 cwt. per statute acre, was laid down in the Spring of 1926 by Assistant Agricultural Overseers at a number of centres in Congested Districts. At about two-thirds of the centres tests were conducted with Semsol and Clare phosphate and at the remaining centres Clare phosphate and M'Dilla mineral phosphate were compared. In the season in which the manures were applied Semsol proved definitely superior to Clare phosphate at all centres. M'Dilla mineral phosphate, whilst slow in producing a beneficial effect, gave better results than Clare phosphate except at a few centres. Reports received at the end of 1927 indicate that during the past season each of the phosphates produced results similar to those obtained in the previous year.

A further series of demonstrations on pasture land with Semsol, Gafsa mineral phosphate and Clare phosphate were laid down by Assistant Agricultural Overseers at 49 centres early in 1927. These phosphates, which were applied at the rate of 8 cwt. per statute acre, were similar in composition to those used in experiments on the turnip crop and on meadow hay conducted by the Agricultural Instructors, particulars of the composition of which may be found on page 12 of this report. A striking feature of the results is that at about half the centres where trials were conducted practically no beneficial effects could be observed as a result of the dressing of Clare phosphate. From six centres it was reported that Clare phosphate produced quite as good results as Gafsa, but at no Centre did the Clare

phosphate give a better return. At all centres where plots were laid down Semsol gave the earliest response, and at 42 out of the 49 centres it produced outstanding returns as compared with the plots dressed with Gafsa and Clare phosphate.

In the Spring of 1925 a series of trials on grass land with Basic Slag, Semsol, Gafsa mineral phosphate, burnt lime and ground limestone were laid down by the Agricultural Instructors at 57 centres in 19 counties. The phosphates were applied at the rate of 6 cwt., the burnt lime at the rate of 1 to 1½ tons, and the ground limestone at the rate of 2 to 3 tons per statute acre. Owing to the difficulty of procuring supplies plots dressed with ground limestone were not included at all centres. A similar series of experiments were again conducted in 1926. In the first season in all series practically similar results were produced by Basic Slag and Semsol, the former showing some slight superiority over the latter. Gafsa, with a few exceptions, did not produce as early a growth or as good returns as Basic Slag or Semsol, but at all centres a distinct improvement was noticeable where it was applied as compared with the unmanured portion of the field. At almost all centres no benefits were observed where burnt lime or ground limestone had been applied. In the second season, that is the year following that in which the plots were laid down, the results obtained from the three phosphatic manures, burnt lime and ground limestone were practically identical with those produced in the year in which the dressings were applied.

Both series of plots were inspected periodically throughout the season of 1927, and Instructors' reports on the trials laid down at 45 centres in 1925 indicate that in the third season Basic Slag, as in the previous years, continued to show a marked improvement as compared with the control or unmanured plot, while Semsol appears to have been less effective than in the second season. Gafsa produced better returns than in the two previous seasons, and at most centres it was superior to Semsol. A striking feature of these trials is that at only about half the centres where the experiment was conducted could any improvement be noticed from the applications of burnt lime and ground limestone, and at practically all of these centres the improvement produced was slight compared with that obtained from the dressings of phosphate manures. In one or two cases, however, the dressings of burnt lime and ground limestone effected a distinct improvement in the appearance of the pastures both as regards colour and increased development of clovers.

From these returns it is evident that, on the generality of soils, dressings of burnt lime and ground limestone to pasture are not likely to produce beneficial effects, even in the third season after application.

IV.—Rotation Experiment with Lime.

During each of the three seasons 1924, 1925 and 1926, experiments were laid down by Agricultural Instructors with the object of determining the

influence of applications of burnt lime and ground limestone over the period of an ordinary four-course rotation. The arrangement of the experiment was as follows:—

Three contiguous plots of one statute rood each were measured off at each centre. One of these plots, which was reserved as a control, received no lime, and the other two were dressed with burnt lime and ground limestone respectively. In the first season's experiments burnt lime was applied at the rate of two tons and ground limestone at the rate of 4 tons per statute acre. In the subsequent seasons the quantities of burnt lime and ground limestone applied per statute acre were reduced to 1½ tons and 3 tons respectively. Owing to the difficulty of procuring adequate supplies of ground limestone, the full series of plots were laid down at only a limited number of centres. The land selected for the trials each season had not been dressed with lime for a considerable number of years, and at many centres there was no record of lime having been applied at any time. The lime and ground limestone were in each of the three seasons applied to the land prior to the sowing of lea oats.

The returns obtained during the first, second and third seasons from the experiments laid down in 1924; the returns for the first and second seasons from the trials commenced in 1925, and the results for the first year from the plots laid down in 1926 were published in previous reports.*

The results obtained during the fourth season of the rotation from 18 centres where the experiment was laid down in 1924 are shown in Table IV. of this report.

At the 14 centres where first crop hay was grown on the plots increased yields were, with one exception, obtained where burnt lime or ground limestone had been applied, and the average increase in yield resulting from the dressing of burnt lime was 8 cwt. per statute acre. Slightly better returns were on the average obtained from the burnt lime than from the ground limestone.

The returns obtained during the third season of the rotation from 14 centres where the experiment was laid down in 1925 are shown in detail in Table V. of this report. It will be observed that while at the majority of the centres better yields were obtained where dressings of burnt lime or ground limestone were applied, the average increase in yield as compared with the unlimed portion of the field is very slight.

The detailed returns obtained during the second season of the rotation from 19 centres where the experiment was originally laid down in 1926 are shown in Table VI. of this report. The results obtained in the past season are similar to those produced in the second year of the rotation in the trials conducted in the earlier years—lime in both forms producing slightly increased yields at almost all centres.

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* Department's JOURNAL, Vol. XXIV., No. 4.; Vol. XXV., No. 4, and Vol. XXVI., No. 4.

The results of these experiments, which have been conducted on a variety of soils during the past four years, indicate generally that applications of burnt lime or ground limestone to tillage land at the beginning of the rotation are likely to produce increased yields for at least four seasons. The additional yield is, however, on the whole so slight that until further evidence is available it is not possible to say definitely if such dressings are economical under average conditions. The results so far obtained also indicate that ground limestone is not as effective as burnt lime even when applied at double the rate at which burnt lime is applied.

TABLE IV.

ROTATION EXPERIMENT WITH LIME.—FOURTH SEASON'S RETURNS, 1927 (18 CENTRES).

County.	Character of Soil.	Crop.	Manures applied per Statute Acre.	No Lime.			Burnt Lime.			Ground Limestone.		
				T.	C.	Q.	T.	C.	Q.	T.	C.	Q.
Clare ...	Peaty Loam ...	Hay (1st Crop)	None	2	0	0	2	4	1		—	
Cork (N.E.) ...	Medium loam ...	do.	do.	2	9	2	2	10	0	2	10	2
Cork (S.E.) ...	Gravelly peaty loam	do.	do.	2	0	2	2	16	2	2	11	0
Cork	Dark loam ...	do.	do.	3	3	1	3	17	1	4	0	0
Cork	Medium loam ...	do.	do.	1	8	2	1	11	1	1	14	1
Cork	Dark loam ...	do.	do.	1	11	3	1	14	1		—	
Kerry ...	Strong loam ...	do.	do.	1	13	0	1	17	0	1	13	0
Kerry ...	Light loam ...	do.	do.	2	8	0	2	18	0		—	
Kilkenny ...	Medium loam ...	do.	do.	2	16	0	3	10	0	3	4	2
Limerick ...	Loam	do.	do.	3	0	0	2	18	0		—	
Meath ...	Clay loam	do.	6 cwt. Potassic Super ...	2	10	0	2	12	0	2	12	3
Offaly ...	Loam	do.	None	1	12	0	1	18	0		—	
Tipperary ...	Heavy clay ...	do.	do.	2	14	0	3	7	2	2	19	0
Tipperary (N.R.)	Stiff mountain clay ...	do.	do.	2	0	0	3	5	0		—	
Mayo ...	Clay loam	Potatoes	16 tons farmyard manure 1 cwt. Sulphate Ammonia 4 cwt. Superphosphate. 1 cwt. Muriate Potash.	12	10	0	13	5	0		—	
Wexford ...	Shingly loam ...	Sugar Beet	4 cwt. Super ... 4 cwt. Kainit. 1 cwt. Sulphate of Ammonia.	6	15	0	6	10	0		—	
				(17·0 per cent. Sugar).			(16·5 per cent. Sugar).					
Kildare ...	Clay loam	Oats ...	None	1	4	0	1	4	2		—	
				(Grain)			(Grain)					
				1	15	0	1	16	0		—	
				(Straw)			(Straw)					
Westmeath ...	Heavy loam ...	Oats ...	5 cwts. Superphosphate	1	2	2	1	3	1		—	
				(Grain)			(Grain)					
				1	14	0	1	15	0		—	
				(Straw)			(Straw)					

County.	Character of Soil.	Crop.	Manure applied per Statute Acre.	No Lime. Grain.	No Lime. Straw.	Burnt Lime. Grain.	Burnt Lime. Straw.	Ground Limestone. Grain.	Ground Limestone. Straw.
				T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.
Clare ...	Medium loam	Oats ...	None	1 5 3	1 17 0	1 4 1	1 14 1	1 8 2	2 3 0
Cork (S.E.) ...	Peaty loam...	do. ...	do.	1 5 2	1 16 1	1 6 0	2 1 0	1 9 1	2 1 3
Mayo ...	Loam ...	do. ...	do.	0 18 3	—	0 19 2	—	—	—
Roscommon ...	Deep heavy clay.	do. ...	do.	1 3 2	—	1 4 3	—	—	
Tipperary (N.R.)	Heavy clay...	do. ...	do.	0 17 3	1 9 0	1 0 1	1 12 2	0 18 3	1 15 0
Westmeath ...	Gravelly loam	do. ...	do.	1 3 2	1 15 3	1 2 3	1 14 2	—	—
Cork	Clay loam ...	Barley	do.	1 2 3	1 14 1	1 2 1	1 12 2	1 3 1	1 13 3
Kildare ...	Medium loam	do. ...	do.	1 0 2	1 4 2	1 2 0	1 5 1	—	—
Limerick ...	Light loam ...	Wheat...	do.	1 5 0	2 2 0	1 6 1	2 4 0	—	—
Meath ...	Clay loam ...	do.	do.	0 17 1	1 12 3	0 18 2	1 11 2	0 17 3	1 10 3
Tipperary (S.R.)	Medium clay	do.	do.	1 5 2	—	1 9 0	—	1 7 2	—
				T. C. Q.		T. C. Q.		T. C. Q.	
Cork	Sandy loam	Potatoes	Farmyard manure, Superphosphate, and Muriate of Potash.	19 18 0	—	20 2 0	—	—	—
Donegal ...	Medium dry loam.	Potatoes	Farmyard manure, 4 cwt. Superphosphate. 1 cwt. Sulphate of Ammonia. 1 cwt. Muriate of Potash.	15 10 0	—	16 0 0	—	—	—
Waterford ...	Reclaimed mountain.	do.	10 cwt. complete potatoe manure.	14 1 0	—	14 11 0	—	—	—

TABLE VI.

ROTATION EXPERIMENT WITH LIME.—SECOND SEASON'S RETURNS, 1927 (19 CENTRES).

County.	Character of Soil.	Crop.	Manure applied per Statute Acre.	No Lime.			Burnt Lime.			Ground Limestone.		
				T.	C.	Q.	T.	C.	Q.	T.	C.	Q.
Dublin ...	Clay loam ...	Turnips	Farmyard manure ... ... 1 cwt. S. of Ammonia ... 4 cwt. Super ... ... 3 cwt. Kainit	16	18	0	20	8	0	17	17	0
Cork (N.E.)	Dark loam ...	Swedes	15 tons farmyard manure ... 4 cwt. Super ... ... 3 cwt. Kainit ... ... 1 cwt. S. of Ammonia ...	25	5	0	25	2	0	25	4	0
Cork (S.E.)	Medium sand-stone loam.	do.	—	18	11	0	23	13	0	20	11	0
Cork (West)	Light loam	do.	Farmyard Manure and Super.	21	16	0	22	1	0	—		
„ ...	Dark loam ...	do.	do. do. ...	24	17	0	25	1	0	—		
Donegal ...	Poor and thin	Turnips	5 cwt. Super ... ... 1 cwt. S. of Ammonia and farmyard manure.	24	0	0	24	14	0	—		
Kildare ...	Grey moor ...	Swedes	4 cwt. Super and farmyard manure.	24	0	0	26	1	0	—		
Do. ...	Clay loam ...	do.	4 cwt. Super and farmyard manure.	25	0	0	29	15	0	—		
Laoighis ...	Stoney loam	do.	13 tons farmyard manure ...	19	10	0	18	19	0	—		
Westmeath	Medium loam	do.	15 tons farmyard manure ... 4 cwt. Super	21	2	0	21	7	0	—		
Kilkenny ...	Medium loam	Potatoes	20 tons farmyard manure ... 4 cwt. Super ... ... 1 cwt. S. of Ammonia ...	12	0	0	14	12	0	—		

Mayo ...	Medium loam	do.	15 tons farmyard manure ... 1 cwt. S. of Ammonia ... 4 cwt. Super ... ... 1 cwt. Muriate of Potash ...	9 13 0		10 4 0		—	
Mayo ...	Loam ...	do.	Farmyard manure and special Potato manure.	9 10 0		9 10 0		—	
Meath ...	Moory clay...	do.	18 tons farmyard manure ... 4 cwt. Super ... ... 1 cwt. Sulphate of Ammonia 1 cwt. Muriate of Potash ...	12 12 0		14 6 0		13 19 0	
Roscommon	Heavy Peaty clay.	do.	Farmyard manure ... ... 4 cwt. Super ... ... 1 cwt. Muriate of Potash ... 1 cwt. S. of Ammonia ...	13 12 0		14 9 0		—	
Cavan ...	Stiff heavy clay.	do.	20 tons farmyard manure and 4 cwt. Special Potato manure	14 6 0		16 1 0		—	
Sligo ...	Wettish heavy loam.	Cabbage	Complete mixture of artificial manures.	13 17 0		16 3 0		—	
Tipperary (N.R.)	Strong clay...	Sugar Beet.	Farmyard manure and 9 cwts. Beet Manure ...	8 14 1 (17·2% Sugar)		10 5 0 (16·3% Sugar)		8 18 0 (17·2% Sugar)	
				Grain	Straw.	Grain.	Straw.	Grain.	Straw.
				T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.
Cavan ...	Stiff clay ...	Oats ...	1 cwt. Sulphate of Ammonia 3 cwt. Super.	1 1 0	1 10 0	1 1 3	1 10 0	—	—

THE NATURE OF CERTAIN "ROGUES" FOUND AMONG CROPS OF SWEDE TURNIPS IN IRELAND.

By H. A. Lafferty, F.R.C.Sc.I.

The yellow-fleshed swede turnip, like most of the so-called agricultural "root crops," should under normal conditions behave as a biennial plant. In other words, it should develop its "root" or "bulb" during its first growing season and, if allowed to continue its growth, in the following year it should produce its flowers, fruits and seeds.

It frequently happens, however, that amongst a crop of true swedes certain individuals are to be found which show a tendency to behave like annuals and produce their flowering stalks in the summer or autumn of the sowing year. Such plants are popularly and correctly referred to as bolted swedes or "bolters." If such a plant is examined it will be found to have a partially developed "root" or "bulb" which, if cut open, will reveal yellow coloured flesh and, except perhaps in the matter of size, will be otherwise indistinguishable from the normal swede "bulbs" growing around it. When fully expanded the petals of its flowers will be found to be buff in colour, or to be more correct, "Naples yellow"*—the normal flower colour of yellow-fleshed swedes. In short, a plant of this type is a true swede which has behaved as an annual and can easily and unmistakably be identified as such.

While the following account is not directly concerned with the causes which bring about bolting in swedes it may be of interest to note that the trouble is intimately bound up with, if not entirely due to, unduly early seed sowing and the incidence of late frosts which tend to check the growth of the young plants. It has been found in Denmark that in a year when night frosts were prevalent early in May, the frequency of bolting was dependent on the date of sowing, and varied from 100 per cent. "bolters" with seed sown on April 1st to 0 per cent. "bolters" when the seed was sown on May 10th.

Similar results, hitherto unpublished, have been obtained in Ireland from trials conducted in 1912 by Dr. Pethybridge. Working with purple-top swede he obtained 60 per cent. "bolters" from seed sown on March 20th, 45 per cent. "bolters" when the seed was sown on April 4th, and 0 per cent. "bolters" when the seed was sown towards the end of May.

During recent years a considerable number of inquiries from farmers and seed merchants have reached the Department as to the identity of certain aberrant Brassica plants which have been found growing in crops of swede turnips. These inquiries have generally been received during the winter months and in most cases have been accompanied by specimens of the abnormal plants, which were variously referred to as "rogues," "sports," "reversions," "hybrids," "bolters" and "rape."

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* Ridgway's "Colour Standards and Nomenclature," Washington, D.C., 1912.

Fig. 1.—A purple-top Swede and Rape Hybrid typical of plants in Group (b)
(See text, p. 32.)

Fig. 2.—A green-top Swede and Rape Hybrid typical of plants in Group (c).
(See text, p. 32.)

Fig. 3.—" Bulb " of plant illustrated in Fig 1, showing coarse roots.

Since genuine yellow-fleshed swede turnips invariably produce "Naples yellow" (buff) coloured flowers, this important feature has been used as one of the principal diagnostic characters in the preliminary attempts made to throw some light on the nature and origin of the abnormal plants referred to above. In many cases these abnormal plants appeared to be identical with bolted swedes, but in other cases plants were received for examination which bore a striking resemblance to rape. As identification depended on the colour of the flowers, and as the majority of the plants were not in flower when received, it was necessary to grow them for a further period. This was done by planting them in pots of soil and keeping them in an unheated greenhouse over the winter and until they flowered in the following spring.

For the first few years during which these investigations were in progress definite opinions as to identity were offered only in those cases where the plants showed evidence of bulbing and produced typical "Naples yellow" flowers." Such plants were pronounced to be swedes which had bolted.

Attempts to identify the rape-like plants, which had dark green leaves, coarse white roots, a complete absence of bulb, and "lemon yellow" flowers (petals), were not so easy, since it was felt that such plants might be true rape plants or possibly hybrids. No opinion, therefore, was offered. except a statement that "rogues" of this type were not genuine yellow-fleshed swede plants and could not be the progeny of genuine yellow-fleshed swede seed.

This provisional and not very satisfactory state of affairs remained until 1924, when an attempt was made to carry the identification of the rape-like plants a stage further. In that year suitable material was received from eight different sources, but unfortunately nothing definite could be learned as to the origin of the seed sown. All the plants in the different lots received resembled rape in having coarse roots, no trace of bulb formation, and dark green leaves. On being kept over the winter in pots of soil in a cool greenhouse, they all produced "lemon yellow" flowers in the following spring. A single typical plant was at this time selected from each of the eight lots and from each plant all opened or partially opened flowers were removed. The plants were then completely enclosed in fine muslin bags in order to prevent cross-pollination.

In due course the plants "selfed" and set seed. When the "pods" were ripe they were removed and the mature seeds carefully collected. In every case the seeds, which were large and black and therefore unlike true swede seed, were kept until the following year when, towards the end of June, fifty from each plant were sown in pans of sterilised soil kept in an unheated greenhouse. Germination took place quickly and a good crop of seedlings was obtained. When the young plants had developed their first pair of true foliage leaves, twenty were removed from each of the eight pans and carefully transplanted in the open, the remaining plants of each lot being potted singly in seven-inch pots of soil and kept indoors.

Under both sets of conditions growth progressed satisfactorily, especially during the summer months. All the plants were alike in appearance and none showed the slightest sign of bulb formation. During the winter months of course, growth slowed down considerably, and the plants remained in a

more or less passive state until early spring, when those in the greenhouse showed signs of renewed activity and soon produced their flowering shoots. At a later date the plants wintered in the open also produced flower shoots and by April all the plants had flowered. In every case the flowers were "lemon yellow" in colour. Owing to the rather unfavourable conditions of pot culture and transplanting to which these plants were subjected they were considerably smaller than their parents, but otherwise they resembled the latter in all essentials. This proved that the parent plants were pure, since they bred true. It also showed that they were in reality true rape plants and that they were the produce of rape seed which must have been present in the original seed. This seed must therefore have been a mechanical mixture of swede and rape seed.

During the autumn of 1926, further reports reached the Department of the widespread occurrence of "rogues" among swede crops, and complaints were received from almost every county in Saorstát Éireann. Enquiries made at this time resulted in tracing the trouble to one particular consignment of seed which reached this country from Scotland. Specimens of the "rogues" were received from several counties, and all the specimens first examined were found to be of the rape type. At first it seemed as if this was another instance resulting from a mechanical mixture of swede and rape seed, but a single plant was received eventually which suggested that the trouble was, in part at least, due to a different cause. This plant showed a copious production of dark green leaves, but, unlike the usual rape-like types previously seen, it had a distinct green-top "bulb," about four inches in diameter, with coarse lateral roots, some of which were over one inch thick at their base. On cutting open this "bulb" the flesh was found to be white and distinctly fibrous in texture.

The finding of such a plant as that just described at once ruled out of account, as far as this type of plant was concerned, the possibility of a simple mechanical mixture of seed as being alone sufficient to explain matters, and very strongly suggested hybridisation (a physiological mixture) as being the cause of at least part of the trouble.

In December, 1926, the writer visited several farms in the counties of Galway and Cork where "rogues" had been prevalent, and were still present, in crops of swedes grown from seed from the particular consignment to which reference has been made. These crops, irrespective of locality or cultivation, resembled each other in having five distinct types of plants present, which could be arranged in the following groups:—

(a) Plants which appeared to be normal purple-top, yellow-fleshed swedes.

(b) Rape-like plants with purple-top, white-fleshed "bulbs" and long, coarse roots.

(c) Rape-like plants with green-top, white-fleshed "bulbs" and long, coarse roots.

(d) Rape-like plants without "bulbs" but with long, coarse roots.

(e) Plants which appeared to be normal green-top yellow-fleshed swedes.

Fig. 4.—A Rape plant typical of plants in Group (d).
(See text, p. 32.)

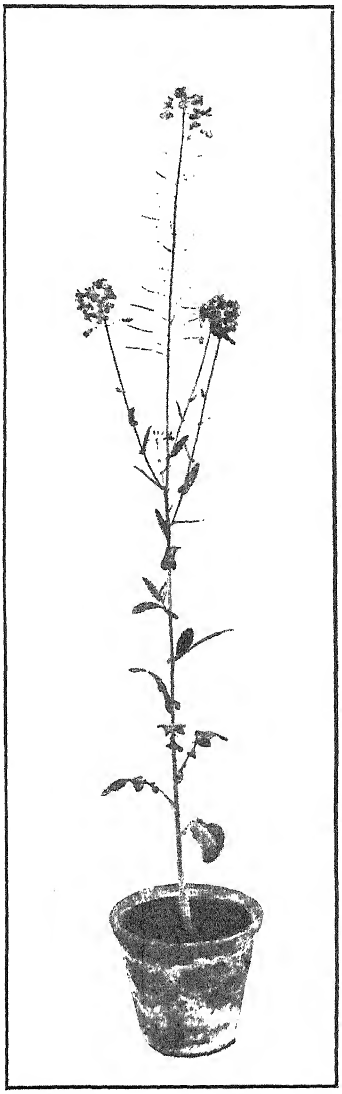

Fig. 5.—One of the plants produced from seed obtained by "selfing" the plant illustrated in Fig. 4.

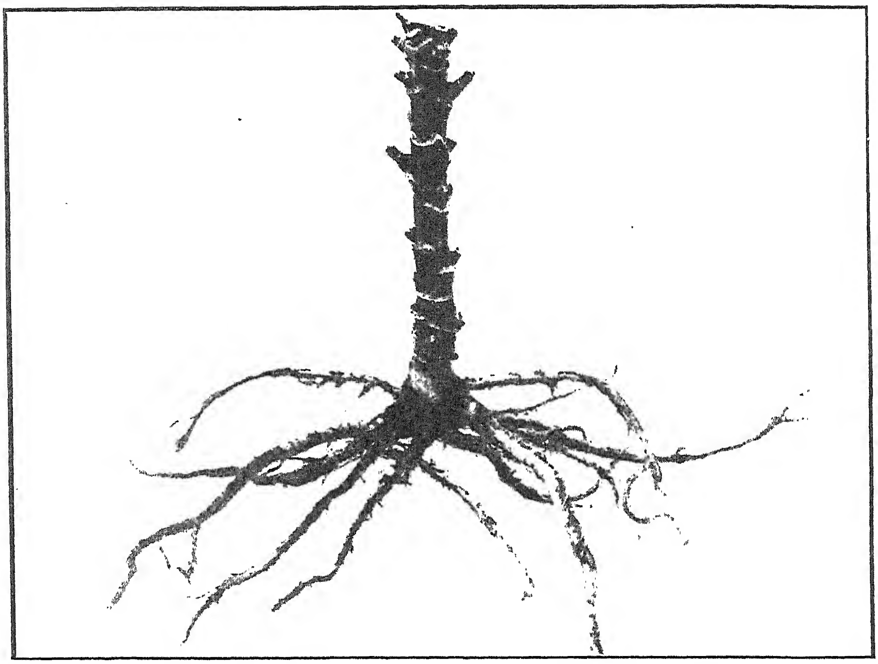

Fig. 6.—The root system of the Rape plant shown in Fig. 4.

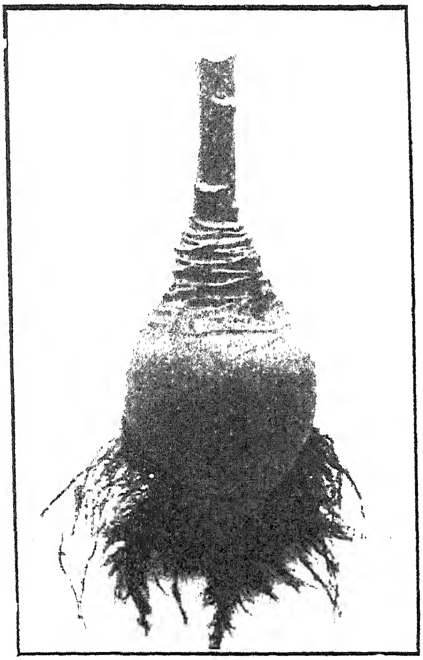

Fig. 7.—A purple-top yellow-fleshed Swede typical of the progeny of a "selfed" Swede from Group (a).
(See text, p. 32.)

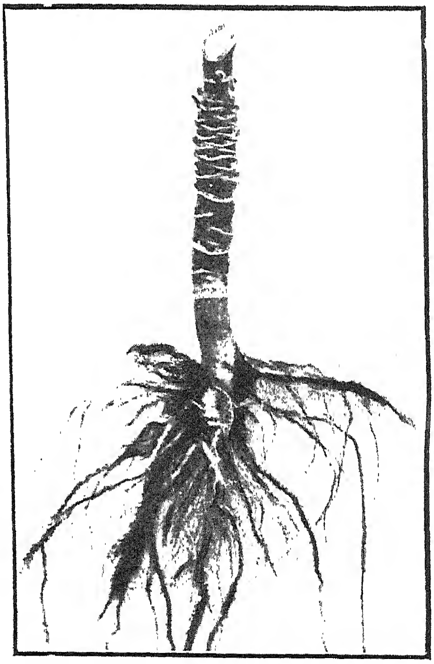

Fig. 8.—Root system of Rape plant illustrated in Fig. 5.

At first it was thought advisable to try and get some *data* as to the relative proportions of the various types present in each crop, but nothing approaching uniformity could be discovered even between adjoining drills of the same crop. This is not surprising, since the operation of thinning undoubtedly played a prominent part in determining the type of plant which was allowed to remain in the drills. It was learned that even at the time of thinning, the suspicions of the workers were aroused by the presence in these crops of different growth-forms in the rows, since many of the seedlings were found to be more strongly developed and of a darker colour than is usual in swedes. In some cases these coarse-growing plants were left to develop, while in others they were, as far as possible, removed as being undesirable; and on this of course depended the relative frequency of their occurrence at the time of the inspection in December, 1926.

After an examination of several swede crops had been made, all the evidence collected tended to indicate that the trouble arose from the sowing of seed which was both mechanically and physiologically impure. In other words, the crops were believed to be made up of (1) purple-top yellow-fleshed swedes, (2) green-top yellow-fleshed swedes, (3) rape plants, and (4) hybrids. The last named were possibly the result of swede and rape crosses. To test this idea, typical specimens of the various kinds of plants were carefully collected, and the investigations were continued at the Department's Seed Testing and Economic Botany Division.

Since none of the plants had flowered at the time of collection, they were planted singly in pots and kept in a cool greenhouse until the following spring, when those belonging to groups (*b*), (*c*) and (*d*) produced flowering shoots at least three weeks earlier than those in groups (*a*) and (*e*). When the first flowers of each plant had opened it was seen that those of the plants belonging to groups (*a*) and (*e*) were "Naples yellow," the true ordinary yellow-fleshed swede colour, whereas all the plants in the remaining groups produced "lemon-yellow" flowers. It was then reasonably clear that, while the plants in the latter groups differed among themselves morphologically, they were also distinctly different from genuine yellow-fleshed swedes.

At this stage one typical plant was selected from each of the groups (*a*), (*b*), (*c*) and (*d*) to be used for "selfing" and further propagation purposes; but as group (*e*) was represented by only one plant, which was indistinguishable from a green-top swede, it was not considered necessary to include it in this series of tests.

The plant selected as typical of group (*a*) appeared to be a normal purple-top yellow-fleshed swede, and, as such, does not require detailed description. The plants of group (*b*) were represented by the specimen illustrated in Fig. 1. It had a purple-top white-fleshed "bulb," about four inches in diameter, and coarse white roots (see Fig. 3). Fig. 2 illustrates the specimen chosen to represent group (*c*). This specimen closely resembled the plant previously described as typical of group (*b*), except that the over-ground part of its "bulb" was green instead of purple. Group (*d*) was represented by the plant shown in Fig. 4, the root of which is also illustrated in Fig. 6. It had no trace of a "bulb."

Towards the end of March, 1927, each of the plants illustrated in Figs. 1, 2 and 4, as well as the normal purple-top swede (*a*) referred to above, were covered with muslin bags, after removal of all existing opened flowers as previously described, and allowed to become " selfed." In all cases the process was successful and a considerable quantity of well developed seed was duly harvested from each plant. On June 17th, fifty seeds were picked at random from each lot, sown in seed pans in sterilised soil and kept in a greenhouse. Germination took place rapidly, and the following crop of seedlings was produced:—

Group (*a*)	...	...	35 plants
Group (*b*)	...	...	31 ,,
Group (*c*)	...	..	39 ,,
Group (*d*)	...	...	43 ,,

By July 6th, these plants were sufficiently well developed to withstand transplanting, and on that date each was placed singly in a seven-inch pot of soil. Owing to lack of space in the pots for extensive root development, the plants remained small, but were otherwise healthy.

A preliminary examination of the growing plants made in the autumn indicated that all those belonging to group (*a*) were identical. They produced small, well shaped purple-top yellow-fleshed " bulbs," and in every detail they resembled true ordinary swedes as grown by farmers in Ireland and elsewhere. A superficial examination of the plants in groups (*b*) and (*c*) suggested that each group was a mixed one, since some of the plants in each showed evidence of bulbing while others were devoid of any trace of bulb formation. The only difference noticeable between groups (*b*) and (*c*) was in the colour of the tops of the " bulbs," where these were present. In the case of the former group they were purple and in the latter green. All the plants in group (*d*) were identical, and indistinguishable from rape: no trace of " bulb " formation was present.

The plants were over-wintered indoors, and no signs of flower-shoot production was noticed until early in February, 1928. From this time onward growth proceeded rapidly, and by the end of the month flowering shoots had developed on certain plants in group (*d*) and the first flowers had opened. In a short time all the individuals in this group flowered freely, and in every case the flower colour was " lemon-yellow." These plants were then removed from their pots and their roots were found to be white and fibrous, without any trace of " bulb " (see Fig. 8). In short, all the plants which developed from the seed obtained by selfing the original plant selected from group (*d*) were pure rape plants, which proved beyond doubt that the plant selected was also a true rape plant, and the produce of a genuine rape seed.

Flower formation among the remaining plant groups developed rapidly, and of these group (*a*), which was the last to flower, will be considered first. All the plants in this series produced small but otherwise normal purple-top, yellow-fleshed " bulbs " (see Fig. 7), and " Naples yellow " flowers, proving, as was to be expected, that they were genuine swede plants and that the parent must also have been a true swede.

As previously mentioned, a preliminary examination in the autumn of

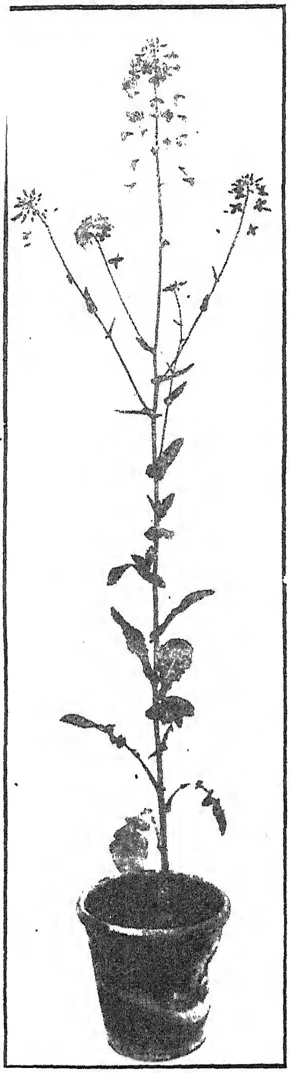

Fig. 9.—A purple-top yellow-fleshed Swede segregant of the "selfed" plant shown in Fig. 1.

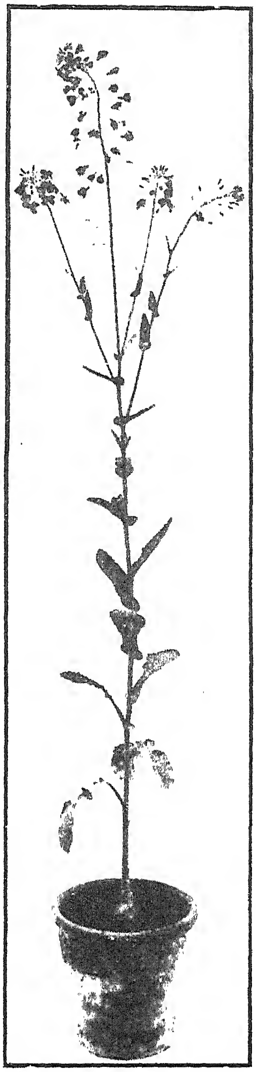

Fig. 10.—A Swede and Rape Hybrid segregant of the "selfed" plant shown in Fig. 1.

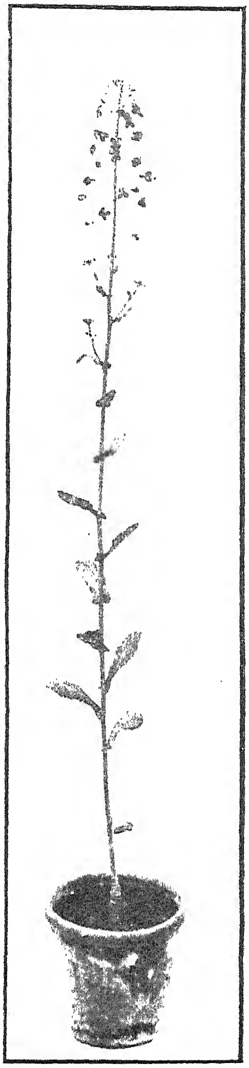

Fig. 11.—A Rape segregant of the "selfed" plant shown in Fig. 1.

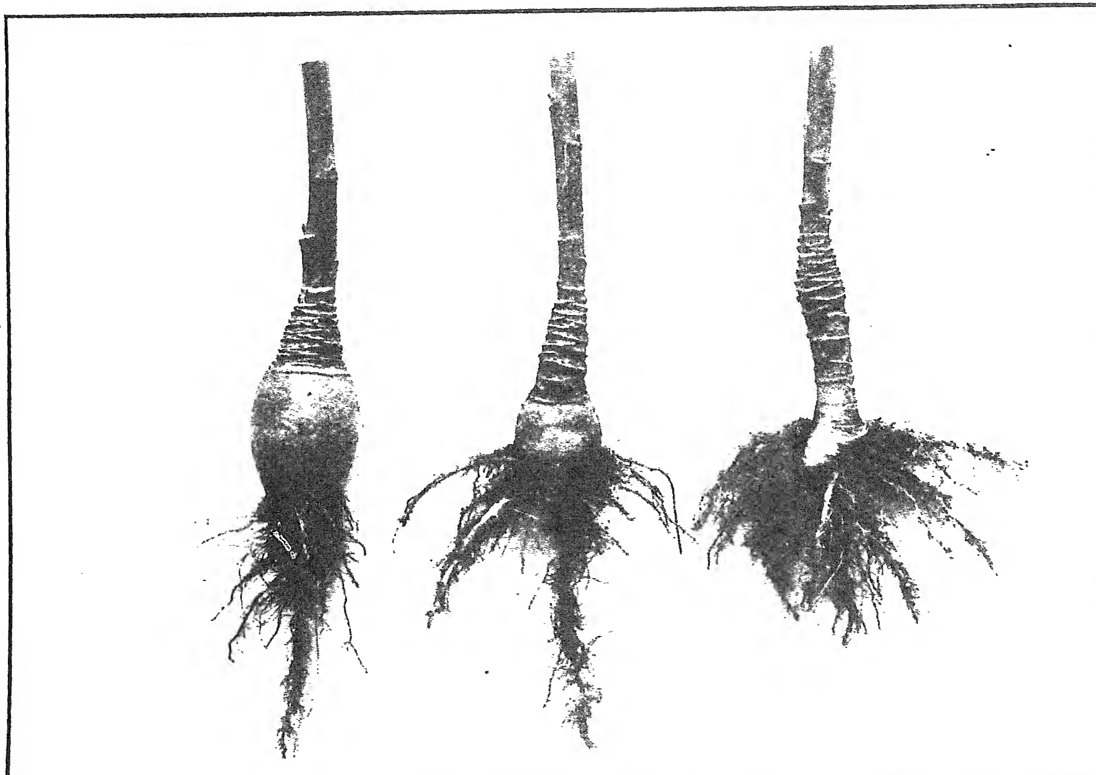

Fig. 12.—From left to right, the "bulbs" and root of the segregants shown in Figs. 9, 10 and 11, respectively.

1927 of the plants in group (*b*) suggested that segregation was taking place, and when the final examination was made in March, 1928, this interesting feature was even more pronounced.

Of the thirty-one plants in this lot, two produced "Naples yellow" flowers and purple-top, yellow-fleshed bulbs, approximately 8 cm. in diameter. These bulbs, though showing a lesser development and more undesirable shapes (especially in the amount of true root formation) than the genuine purple-top swede, illustrated in Fig. 7, were nevertheless indistinguishable from swedes when judged by the colour and consistency of the flesh, and the colour of the flowers. One of these plants is illustrated in Fig. 9. Two other plants produced "lemon-yellow" flowers, coarse white roots without "bulbs," and were undoubtedly rape (see Fig. 11), while the remaining twenty-seven plants, one of which is shown in Fig. 10, had "lemon-yellow" flowers and purple-top, fibrous, white-fleshed "bulbs," with coarse, lateral roots. The "bulbs" of these plants were found to vary from 1.5 cm. to 4 cm. in diameter

The important feature of this segregation was the finding in the group of two plants resembling true swedes and two rape plants. This result made it possible to identify the parent plant as a hybrid, one parent of which was a purple-top swede and the other a rape plant.

When a yellow-fleshed swede is crossed with rape the "lemon-yellow" colour of the flowers characteristic of the rape is dominant, as also is the white flesh; consequently it is reasonable to assume that the twenty-seven plants, which appeared in the above culture, with "lemon-yellow" flowers and white-fleshed "bulbs" were hybrids; but as their exact identity was of minor importance the question was not followed further. Fig. 12 shows, for comparison, the underground parts of the segregants, namely, a swede, a hybrid, and a rape plant respectively.

In the lots of group (*c*), results were obtained which were very similar to those just described. Of the thirty-nine plants in this series two developed green-top, yellow-fleshed "bulbs," 3 cm. and 4 cm. in diameter respectively. They had "Naples yellow" flowers and resembled green-top swedes, although in this case there was also an unusual amount of true root formation; nine were identical with rape in having "lemon-yellow" flowers and being devoid of bulbs, while the remaining twenty-eight plants had "lemon-yellow" flowers and green-top, fibrous, white-fleshed bulbs, with coarse, lateral roots. In this as in the previous instance, the parents of the original selfed plant were evidently a yellow-fleshed swede and a rape plant: but since purpling of the bulbs in the second generation of plants was absent, the swede parent was probably of the green-top variety—a supposition which is borne out by the finding of true green-top swedes in the crops at the time of inspection.

At this late stage it is impossible to reconstruct with certainty the chain of events which resulted in the original seed becoming impure to the extent it did; but from the investigations just described, it is clear that the principal factor involved was cross-fertilisation of the two kinds of mother swedes by rape. There is no evidence to suggest that this stock of seed was not, in an earlier generation, pure purple-top swede seed; but the finding

of a certain number of green-top swedes among the crops most strongly suggests that at some time or other it became mixed, possibly through accident, with seed of a green-top variety. The presence of true rape plants and hybrids among the crops might be due to one or other of two causes, namely, a mechanical admixture of rape seed with subsequent cross-fertilisation; or direct cross-fertilisation of the mother swedes by rape growing in their immediate vicinity during one of the years in which the former were being grown for seed production.

The production of swede seed for agricultural purposes is a matter requiring very great care, and experienced raisers of such seed take every precaution to ensure constitutional purity and freedom from contamination resulting from crossing with other Brassicas. As a special precaution many seed raisers adopt a system of "proving" their swede seed before distribution. In other words, the seed is not liberated for sowing in the year following harvest, but in that year portions of it are sown in special trial grounds to ensure that the bulk is genuine, true to name and contains no "rogues." If the crop produced is found to be satisfactory, the seed is liberated the following year for sowing purposes. The cost of seed produced under such carefully controlled conditions may be a trifle higher than the general run of commonplace seed, but it is well worth the extra cost. Cheapness and inferiority generally run hand in hand.

In actual seed-raising practice the presence of rape seed as a mechanical mixture among genuine swede seed may pass unnoticed at the time of sowing, and by subsequent cross-fertilisation of the two types of plant produced, provided the rape has not been removed at the time of "roguing," a mixture of seed may be distributed which in its first year will give rise to swedes, rape, and swede and rape hybrids. Fortunately, however, rape plants if sown at the same time are generally in flower earlier than swedes, and this fact is taken advantage of during "roguing" operations.

Even in the absence of such a mechanical mixture of seed as that just described, the mother swedes may become cross-fertilised by rape from an adjacent field, and the seed from such a crop would, if distributed for sowing purposes, give rise in the first year to swedes and hybrids only, but if re-sown to produce a further accumulation of stock seed, and then distributed, segregation of the hybrids would take place and swedes, rape and hybrids would once more appear.

To sum up the particular case under consideration, all the evidence produced goes to show, firstly, that the purple-top swede seed became mixed with seed of a green-top variety; and, secondly, that further contamination took place through the introduction of rape, either in the form of a mechanical or physiological mixture. It also serves as a striking example to seed merchants of the absolute necessity for having their root crop seeds "proved" before distributing them for sowing purposes. Had such precautions been taken in this case the inconvenience and financial loss which undoubtedly accrued to all concerned would have been avoided and the confidence of the farmer in his seed-merchant would not have suffered the severe shock it has.

SUGAR BEET EXPERIMENTS, 1927.

PREVIOUS TRIALS.

As a result of experiments on the cultivation of sugar beet conducted by the Department during the three seasons 1911-12-13 it was shown—

(1) That with proper care and cultivation satisfactory crops of sugar beet could be grown in Ireland.

(2) That the most satisfactory results were likely to be obtained where the beet was grown in narrow moulded-up drills.

(3) That the heaviest yields were obtained where a top-dressing of nitrate of soda was applied to the crop in addition to a dressing of farmyard manure and a complete mixture of artificial manures.

In view of the Government's decision to promote the establishment of the sugar beet industry in this country the Department arranged for the conduct, during the seasons of 1925 and 1926, of a number of experiments with sugar beet. These tests were carried out under the supervision of the Agricultural Instructors in each county in the Saorstat and also at the Department's Farms. The results of these experiments, which were published in the Department's Journal, Vol. XXVI., No. 1, and Vol. XXVII., No. 1, and also in leaflet form, showed—

(1) That of the four varieties of sugar beet tested the Dutch variety (Kuhn & Co.'s " P ") and the German variety (Klein Wanzleben Original " Z ") proved to be somewhat superior, particularly in regard to sugar content, to the Danish variety (The Scandinavian Seed Company's " K 7866 ") and the French variety (Vilmorin's Improved Selection " B ").

(2) That satisfactory crops of sugar beet can be grown on a great variety of soils and that soils capable of growing satisfactory root crops may be considered suitable for the production of sugar beet.

(3) That the position which the sugar beet crop occupied in the rotation did not appear to have any material influence on the yield or sugar content of the beet.

(4) That, on most soils it was desirable to apply a moderate dressing of farmyard manure, either to the beet crop or to the preceding crop, in addition to a complete mixture of artificial manures.

(5) That the time of the year at which farmyard manure was applied for the sugar beet crop, *i.e.*, whether the manure was ploughed in during the winter or was applied in the drills immediately before the seed was sown, did not appear to exercise any appreciable influence on the shape of the roots produced or on the value of the crop as determined by its yield and sugar content.

(6) That a dressing of artificial manures consisting of 4 cwt. superphosphate (35%), 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre applied immediately before sowing the sugar beet seed gave quite satisfactory returns as compared with the results obtained from certain modifications of this dressing. No benefit appears to have been derived from the application of the phosphatic and potassic manures in the winter instead of in the spring.

(7) That a top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre applied after the crop was singled increased the average yield slightly without lowering to an appreciable extent the average sugar content of the beet. That the average increase in the value of the crop was barely sufficient to pay for the cost of the top-dressing but it should be observed that this top-dressing proved useful in stimulating the growth of crops which were backward because of the attacks of mangel fly or as a result of unfavourable soil or weather conditions.

(8) That thorough and frequent after-cultivation was necessary for the maximum development of the sugar beet crop.

THE 1927 EXPERIMENTS.

The Department again arranged for the conduct, during the 1927 season, of two series of experiments with sugar beet:—

(1) Experiments under the supervision of the Agricultural Instructors in each county of the Saorstat; and

(2) Experiments at the Department's Farms and at the Albert Agricultural College (University College, Dublin).

I.—COUNTY EXPERIMENTS.

The experiments conducted by the Agricultural Instructors consisted of two series:—

(a) Variety and top-dressing trials.

(b) Manurial experiments.

VARIETY AND TOP-DRESSING TRIALS.

These trials were conducted by the Agricultural Instructors on lines similar to those adopted in the case of the sugar beet trials carried out in 1925 and 1926. The general conditions of the scheme of experiments were as follows:—

(1) That the area of the experimental plot at each centre should be one statute acre, except in the case of plots laid down in Counties Cavan, Donegal, Galway, Leitrim, Longford, Mayo, Monaghan, Roscommon, Sligo, where the area of each plot should be one-quarter statute acre.

(2) That the experimental plot at each centre should be sub-divided into 5 equal parts and cropped with five varieties of sugar beet, namely,—Danish (The Scandinavian Seed Co.'s "K 7866," Dutch (Kuhn & Co.'s "P"), French (Vilmorin's Improved Selection "B"), German (Klein Wanzleben Original "Z") and Wohanka (Wohanka & Co., Prague).

(3) That the sugar beet should be grown on land which in the previous season had been under tillage, preferably a corn crop, save that in districts where it is customary to grow roots after lea the beet might occupy the position usually taken by the root crop.

(4) That sugar beet grown on land which in the previous season had borne a corn crop should be manured with farmyard manure at the rate of about twelve tons per statute acre ; a similar dressing to be given in the case of plots laid down on " manured " land, if considered necessary.

(5) That the following dressing of artificial manures should be applied at the time of sowing the crop, irrespective of the previous crop or manuring—

4 cwt. Superphosphate (35%)	Per statute acre.
4 cwt. Kainit	
1 cwt. Sulphate of Ammonia	

(6) That one-half of each sub-plot (*i.e.*, one half of the area under each of the five varieties of sugar beet) should be top-dressed, after the crops were singled, with nitrate of soda at the rate of 1 cwt. per statute acre.

(7) That the land on which the plots were to be laid down should be ploughed deeply, care being taken not to bring to the surface sub-soil containing substances deleterious to plant growth.

(8) That the seed bed should be as finely prepared as is customary in the case of the turnip crop.

(9) That the width of the drills should not exceed 24 inches if farmyard manure was applied immediately before the crop was sown and the width of the drills should not exceed 22 inches if farmyard manure was ploughed in, or if it was not applied directly to the sugar beet crop.

(10) That the seed should be sown at the rate of 18 lb. per statute acre, and not later in each district than is customary in the case of mangels, or as soon thereafter as a proper seed bed could be prepared.

(11) That the drills should be horse-hoed at least once within a month from the date of sowing the crop and that, if necessary, this operation should be repeated before the crop was singled.

(12) That the plants should be singled to nine inches apart as soon as they had developed four leaves, exclusive of the cotyledons or primary seed leaves.

(13) That subsequent to singling, and until the leaves had met across the drills, the crop should be hand-hoed and horse-hoed as often as might be necessary to check completely the growth of weeds, and to maintain the surface soil in a loose, friable condition.

(14) That the crop should be moulded up when the foliage of the plants had reached such a stage that further cultivation was no longer necessary or practicable.

(15) That the yield of the crop on the various sub-plots should be determined as soon as the crop had reached maturity.

(16) That representative samples drawn from the various sub-plots should be forwarded to the State Laboratory for analysis.

In accordance with this Scheme experiments were conducted at 139 centres throughout the Saorstat. The number of experimental centres in each county is shown in Table I.

TABLE I.

County.	Number of Centres.	
LEINSTER.		
Carlow	4	
Dublin	4	
Kildare	4	
Kilkenny	4	
Laoighis	4	
Longford	4	
Louth	4	
Meath	4	
Offaly	4	
Westmeath	4	
Wexford	4	
Wicklow	4	
	—	48
MUNSTER.		
Clare	4	
Cork	18	
Kerry	7	
Limerick	8	
Tipperary, N.	4	
,, S.	4	
Waterford	4	
	—	49
CONNAUGHT.		
Galway	8	
Leitrim	4	
Mayo	8	
Roscommon	6	
Sligo	4	
	—	30
ULSTER.		
Donegal	4	
Cavan	4	
Monaghan	4	
	—	12
TOTAL		139

Weather Conditions.

From 20th November, 1926, until the middle of January, 1927, the rainfall was considerably below normal. The last fortnight in January was wetter than usual, but February was a comparatively dry month. From the latter

end of February up to nearly the middle of April the weather was comparatively mild but very wet. The following eight weeks, excepting the first week of May, were abnormally dry. During the third week of May and throughout the month of June harsh, chilly weather prevailed. The deficiency in rainfall was relieved about mid-June and throughout the month of July conditions were quite favourable for growth. From the end of the first week of August to the 1st of October the rainfall was excessive and air temperatures were generally below normal. The first 3 weeks of October were comparatively dry but night temperatures were low. Then ensued a very wet fortnight followed by five weeks of rather dry weather during which severe night frosts were frequent. During the latter half of December the weather was remarkably severe and heavy frosts and snowfalls occurred generally. In January, 1928, the rainfall was excessive and the ground remained sodden up to the close of the 1927-28 campaign.

Preparation of the Land for Seeding.

The dry weather which prevailed during the winter facilitated ploughing operations, but further cultivation in preparation for the sugar beet crop was backward and heavy soils in particular were prepared with some difficulty owing to the wet period of weather which extended from mid-February to mid-April. In most cases farmyard manure was put in the drills immediately before the seed was sown but at a few centres it was applied in winter before the land was ploughed. Owing to the weather conditions prevailing throughout the spring greater difficulty was experienced in producing a fine seed bed and in making the narrow drills recommended for sugar beet than in the two previous seasons.

Seeding.

In addition to the four varieties of seed which were included in the 1925 and 1926 trials a fifth variety, Wohanka, produced by Messrs. Wohanka & Co. of Prague, was included in the 1927 trials. Before the seed was despatched to the plot-holders a representative bulk sample of each of the five varieties was drawn and tested for germination at the Department's Seed Testing Station with the following results :—

Variety.	*Germination per cent.*
Danish (Scandinavian Seed Co. K 7866)...	115
Dutch (Kuhn & Co. P)	185
French (Vilmorin's Impd. Selection B) ...	153
German (Klein Wanzleben Original Z) ...	200
Wohanka (Wohanka & Co., Prague) ...	175

The weather during the last fortnight of April was quite favourable for the sowing of beet, but less than 12 per cent. of the plots were sown during that period mainly on account of difficulty in preparing the land. The first week of May was wet, but during the remainder of the month the weather was dry and fine. Up to the 10th of May less than 60 per cent. of the plots

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SHOWING AVERAGE RETURNS FOR EACH COUNTY AND PROVINCE IN RESPECT OF CENTRES

Province.	County.	Number of Centres.	TOP DRESSED WITH — Average Yield per Statute Acre (Factory Weight). Danish Variety.		Dutch Variety.		French Variety.		German Variety.		Wohanka Variety.		Average Sugar. Danish Variety.	Dutch Variety.
			T.	C.	T.	C.	T.	C.	T.	C.	T.	C.	%	%
LEINSTER ...	CARLOW	4	9	9	10	2	9	7	10	2	9	5	17·4	17·9
	DUBLIN	3	10	17	10	10	9	19	10	5	9	9	17·5	17·8
	KILDARE ...	4	9	7	10	14	10	0	9	16	8	17	17·5	17·9
	KILKENNY ...	4	9	18	10	9	10	0	10	8	9	3	17·8	18·5
	LAOIGHIS ...	4	12	0	12	11	11	9	11	15	10	2	18·1	17·0
	LONGFORD ...	–	–		–		–		–		–		–	–
	LOUTH	1	10	17	11	19	11	8	10	2	9	10	17·6	17·9
	MEATH	3	13	18	14	16	14	1	17	5	17	7	16·0	16·4
	OFFALY ...	3	10	7	10	19	10	8	10	13	9	3	17·6	18·3
	WESTMEATH ...	4	11	19	11	15	12	0	13	3	12	19	16·9	16·7
	WEXFORD ...	4	12	19	13	18	13	2	13	9	11	1	16·6	16·4
	WICKLOW ...	4	8	15	8	19	8	12	8	19	8	18	17·8	17·9
MUNSTER ...	CLARE	2	11	4	11	8	11	18	11	8	10	10	17·4	17·8
	CORK	14	12	2	11	19	11	4	12	3	10	6	16·	17·6
	KERRY	3	13	4	12	15	12	10	13	5	10	19	16·7	17·7
	LIMERICK ...	4	11	18	10	9	10	12	10	11	9	14	17·4	17·5
	TIPPERARY, N.R. ...	3	9	9	9	11	8	19	9	7	9	3	17·5	18·2
	TIPPERARY, S.R. ...	4	12	4	11	18	11	17	12	1	10	17	18·2	19·0
	WATERFORD ...	4	11	15	12	9	12	6	11	1	10	10	16·7	17·7
CONNAUGHT ...	ROSCOMMON ...	2	11	9	12	8	13	1	11	2	12	13	16·4	18·2
	SLIGO	2	10	3	9	4	10	15	10	15	8	10	15·5	16·0
ULSTER	CAVAN	1	10	6	10	3	10	3	9	15	9	3	15·4	16·9
	DONEGAL ...	4	9	11	10	9	10	3	11	5	9	11	17·4	18·4
	MONAGHAN ...	3	8	17	10	3	10	2	9	15	9	18	17·1	18·1
PROVINCIAL AVERAGES:—														
	LEINSTER ...	38	10	19	11	8	10	17	11	9	10	10	17·3	17·5
	MUNSTER ...	34	11	17	11	13	11	5	11	12	10	5	17·0	17·8
	CONNAUGHT ...	4	10	16	10	16	11	18	10	18	10	12	15·9	17·1
	ULSTER	8	9	8	10	6	10	2	10	10	9	12	17·1	18·1
AVERAGES FOR AN SAORSTAT		84	11	3	11	8	11	0	11	8	10	6·5	17·1	17·6

VII.

Conducted by the Agricultural Instructors.

(Factory Weight).					Sugar Content of Roots.									
cwt. 4 Super. 4 Kainit. 1 Suplh. Amm.	cwt. 4 Super. 4 Kainit. 2 Sulph. Amm.	cwt. 4 Super. 4 Kainit. Calcium Cyana-mide	cwt. 4 Super. 4 Kainit. 1 Nitrate of Soda	cwt. 4 Super. 4 Kainit. 2 Nitrate of Soda	cwt. 3 Super. 4 Kainit. 1 Sulph. Amm.	cwt. 5 Super. 4 Kainit. 1 Sulph. Amm.	cwt. 6 Super. 4 Kainit. 1 Sulph. Amm.	cwt. 4 Super. 3 Kainit. 1 Sulph. Amm.	cwt. 4 Super. 5 Kainit. 1 Sulph. Amm.	cwt. 4 Super. 4 Kainit. 1 Sulph. Amm.	cwt. 4 Super. 4 Kainit. 2 Sulph. Amm.	cwt. 4 Super. 4 Kainit. Calcium Cyana-mide	cwt. 4 Super. 4 Kainit. 1 Nitrate of Soda	cwt. 4 Super. 4 Kainit. 2 Nitrate of Soda
T. C.	T. C.	T. C.	T. C.	T. C.	%	%	%	%	%	%	%	%	%	%
9 19	9 19	9 11	9 18	10 1	18·3	18·9	18·2	18·2	18·2	18·6	18·2	18·0	17·0	18·0
8 15	9 13	8 19	9 8	9 12	17·8	17·8	17·4	18·2	18·3	16·6	18·0	17·2	17·6	17·2
9 5	9 14	9 6	9 8	9 13	17·7	17·7	17·8	18·3	17·2	18·0	18·1	17·2	16·8	17·0
8 0	9 5	7 17	7 14	9 7	18·8	19·2	18·8	18·8	18·7	18·2	18·2	18·2	18·8	19·5
8 18	10 0	8 13	8 1	9 3	18·0	18·0	18·0	17·4	17·8	18·0	17·0	18·1	18·2	18·3
11 14	12 6	10 18	10 6	11 16	18·9	18·7	18·5	18·0	17·0	18·6	17·1	17·6	18·4	18·0
9 4	9 19	8 14	8 13	9 7	17·7	17·3	17·7	17·5	18·0	17·0	16·6	17·5	18·0	18·1
8 19	9 9	8 6	8 0	9 9	18·5	19·0	18·5	18·5	18·4	18·5	18·5	18·8	19·0	18·5
10 12	9 12	9 9	11 15	11 0	19·2	18·6	18·4	18·7	19·1	18·8	19·4	18·6	18·7	18·6
12 0	12 0	9 10	9 15	12 0	18·7	19·0	19·4	19·0	19·7	19·1	19·4	19·0	18·8	18·7
10 0	12 0	9 9	10 18	9 18	19·3	19·1	19·6	19·1	19·1	18·7	18·8	18·7	19·0	19·0
10 14	11 17	10 0	10 11	10 8	19·0	19·2	19·2	18·5	19·0	18·7	19·2	18·9	18·2	18·7
9 11	10 17	9 6	10 8	11 0	18·2	19·4	19·3	18·6	18·7	18·7	19·4	19·3	18·3	19·3
12 8	13 3	12 11	11 17	12 5	18·5	18·4	18·4	18·7	18·1	18·5	18·3	17·4	18·1	17·3
10 17	11 14	10 11	11 8	12 6	16·5	19·6	19·2	19·6	19·2	19·1	18·8	18·8	18·6	19·5
10 14	10 19	9 17	10 8	9 12	19·0	18·7	18·5	18·8	19·6	19·7	19·6	19·0	19·1	19·4
11 6	12 4	12 2	11 12	12 2	17·9	17·4	17·8	17·6	17·7	17·7	17·9	18·6	18·4	17·7
10 14	10 0	9 5	9 11	9 12	18·2	18·6	19·1	18·8	18·7	18·5	18·1	18·8	19·1	18·6
8 15	8 15	8 18	8 14	8 19	18·6	18·8	17·9	18·1	18·2	18·0	17·6	17·8	17·6	18·0
11 9	10 13	10 8	10 17	11 14	15·8	17·5	17·5	17·6	18·9	19·0	18·8	18·2	18·3	18·0
10 8	9 3	8 15	8 14	10 2	16·5	16·5	16·2	16·8	17·4	17·7	17·1	17·7	17·9	18·5
8 13	9 12	8 16	8 15	8 18	17·8	17·7	18·3	18·5	18·4	17·3	17·6	18·6	17·6	18·2
10 18	11 1	10 17	10 15	10 18	16·6	17·4	16·2	17·3	16·8	17·2	18·2	17·0	16·6	16·5
12 15	11 16	13 1	12 0	12 7	18·1	18·6	18·2	18·3	17·9	17·5	18·0	18·1	18·4	17·2
10 3	10 15	9 8	9 6	9 3	17·5	17·7	17·0	17·5	17·9	17·7	16·9	17·5	17·5	16·8
10 0	10 18	11 12	11 18	11 15	17·5	18·5	18·2	18·2	18·0	17·2	17·8	15·8	17·4	17·9
10 5	8 15	9 0	9 7	10 0	17·1	17·5	17·9	17·8	17·7	17·5	16·5	17·6	17·1	18·0
12 0	10 18	11	11 6	12 10	17·1	17·2	18·4	17·0	17·6	16·8	16·7	16·9	16·2	16·2
13 3	11 15	11 18	12 15	13 0	16·7	16·8	17·3	17·6	17·1	16·7	17·5	18·0	18·1	15·6
8 18	9 3	8 19	9 0	9 5	17·2	17·2	17·8	17·5	17·4	18·2	16·9	13·7	15·0	15·0
9 0	9 4	8 12	9 4	9 5	18·4	17·9	17·5	17·5	17·1	17·7	18·4	17·3	17·8	17·4
10 6	10 11	9 17	10 1	10 10	17·9	18·2	18·1	18·1	18·1	18·0	18·0	17·9	17·9	17·9

SHOWING RESULTS OF MANURIAL TRIALS

No.	Name and Address of Plotholder	Nature of Soil	Crop grown on the land in 1926	Date of Sowing	Date of Singling	Date of Weighing of Crop	Date of Analysis of Samples	Yield per Statute				
								cwt. 3 Super. 4 Kainit 1 Sulph. Amm.	cwt. 5 Super. 4 Kainit 1 Sulph. Amm.	cwt. 6 Super. 4 Kainit 1 Sulph. Amm.	cwt. 4 Super. 3 Kainit 1 Sulph. Amm.	cwt. 4 Super. 5 Kainit 1 Sulph. Amm.
								T. C.	T. C.	T. C.	T. C.	T. C.
	Co. Carlow.											
113	Murphy, Michael, Newstown, Tullow	Loam	Oats	24 May	30 June	21 Nov.	25 Nov.	9 0	9 14	9 18	9 12	9 8
36	Kavanagh, Jeremiah, Ouragh, Tullow	Light Loam	Oats	21 May	6 July	7 Nov.	10 Nov.	8 12	8 9	8 19	8 14	9 4
7	Byrne, Mrs. B. M., Paulville, Tullow	Loam	Oats	17 May	11 July	2 Nov.	4 Nov.	9 4	9 7	9 13	9 4	9 2
	Co. Kildare.											
—	Spiers, A. L., Burtown, Athy ...	Clay Loam	Oats	6 June	20 July	16 Dec.	17 Dec.	7 15	8 6	8 10	7 16	8 2
143	Bury-Weld, Mr. Somerton, Naas ...	Clay Loam	Oats	25 May	30 June	30 Nov.	2 Dec.	8 12	9 7	9 8	8 2	9 0
131	Greene, John N., Kilkea Lodge, Mageney.	Heavy Loam	Oats	6 May	25 June	25 Nov.	29 Nov.	9 19	11 3	11 6	10 11	11 2
80	O'Connor, James, Elm Hall, Celbridge	Deep Loam	Oats	17 May	24 June	16 Nov.	18 Nov.	8 2	9 4	9 16	9 2	9 7
	Co. Kilkenny.											
128	Broderick Walter, Croan, Dunnamaggin.	Medium Loam	Barley	18 May	25 June	26 Nov.	29 Nov.	8 18	9 3	[illegible] 3	8 18	7 15
53	Mathers, James, Rathcash, Clifden	Medium Loam	Barley	6 May	15 June	10 Nov.	12 Nov.	10 6	10 12	10 15	11 9	10 18
52	Downey, John, Carran, Dunbell ...	Clay Loam	Oats	10 May	21 June	10 Nov.	12 Nov.	10 18	11 0	12 18	10 0	11 17
1	Hughes, Nicholas, Balief, Woodsgift	Medium Loam	Oats	6 May	18 June	22 Oct.	28 Oct.	9 6	11 12	12 4	9 3	10 15
	Laoighis.											
101	Harte, Patrick, Anster, Ballacolla ...	Light Loose Loam	Oats, no Manure	20 May	7 July	19 Nov.	22 Nov.	10 8	10 14	11 11	9 18	10 14
62	Campion, L., Clonmeen South, Rathdowney.	Medium Loam	Oats, no Manure	10 May	24 June	9 Nov.	12 Nov.	10 14	10 3	9 16	10 11	10 11
39	Dowling, John, Derrydavy, Mountmellick.	Light Brown Loam	Barley, no Manure	9 May	22 June	7 Nov.	10 Nov.	10 5	11 11	12 0	10 14	11 3
6	Costello, Michael, Upper Lea, Portarlington.	Medium Loam	Barley, no Manure	6 May	19-22 June	3 Nov.	4 Nov.	10 6	11 0	12 0	11 3	12 1
	Offaly.											
77	Foy, John, Welsh Island, Geashill ...	Medium Loam	Barley	7 May	25 June	16 Nov.	17 Nov.	9 12	10 10	10 17	10 1	10 9
37	McLoughlin, Joseph, Ballydaly, Tullamore.	Loam	Oats	6 May	23 June	7 Nov.	9 Nov.	12 10	13 5	12 12	11 16	12 4
9	Doyle, James, Kildangan, Tullamore	Strong Moor.	Oats	10 May	—	3 Nov.	5 Nov.	9 13	9 8	9 0	9 0	10 14
	Co. Tipperary, N.R.											
154	Maher, William, Laha, Templemore	Strong Clay	Oats	20 May	23 July	2 Dec.	5 Dec.	8 4	8 8	8 5	9 8	9 3
95	Cross, James P., Norwood, Nenagh ...	Strong Clay	Oats	16 May	20 June	19 Nov.	21 Nov.	10 14	11 12	12 11	11 9	11 13
93	Russell, James, Boulesea, Templetuohy, Templemore.	Black Loam	Barley	24 May	14 July	18 Nov.	19 Nov.	8 9	8 14	9 14	9 10	10 13
67	Esmonde O. E., Dromenagh, Borrisokane.	Heavy Loam	Oats	21 May re-Sown 14 June	30 July	11 Nov.	14 Nov.	7 12	7 14	8 5	8 8	8 13
	Co. Waterford.											
82	Kiersey, John, Ballyhussa, Kilmacthomas.	Shingly Red Sandstone Loam	Oats	12 May	27 June	11 Nov.	18 Nov.	10 0	11 3	11 12	10 2	10 13
46	Morrissey, Patrick, Affane, Cappoquin	Limestone Loam	Wheat	8 May	22 June	8 Nov.	11 Nov.	12 4	13 10	13 1	12 15	12 13
26	(Reps.) Morrissey, William, Ballinaskeagh, Dungarvan.	Medium Loam.	Oats	6 May	8 June	3 Nov.	7 Nov.	10 0	9 18	9 18	10 3	10 15
	Co. Wexford.											
123	Scallan, Peter, Clonroche	Shingly Loam	Oats	7 May	10 July	26 Nov.	28 Nov.	10 6	10 3	10 6	11 15	11 10
103	Fortune, Richard, Doonon[illegible], Adamstown.	Loam	Oats	21 May	8 July	22 Nov.	23 Nov.	10 15	10 5	10 0	10 15	10 0
73	O'Neill, Mrs. Mary, Shan[illegible], Bridgetown.	Heavy Clay	Oats	20 May	10 July	15 Nov.	16 Nov.	11 9	13 0	13 0	12 10	11 6
18	Furlong, Thomas, Knockr[illegible]h, Adamstown.	Shingly Loam	Oats	9 May	12 July	4 Nov.	7 Nov.	12 18	10 12	11 9	11 6	13 3
	Co. Wicklow.											
64	Burke, Patrick, Lackeragh, Baltinglass.	Deep Loam	Oats	24 May	4 July	11 Nov.	14 Nov.	8 14	9 0	9 4	8 16	8 19
149	Fisher George, Mergenstown Demesne, Dunlavin.	Dark Loam	Oats	25 May	4 July	2 Dec.	5 Dec.	8 14	9 3	9 2	8 15	8 17
	Averages for 31 Plots ...	—	—	—	—	—	—	9 16	10 5	10 11	10 1	10 8

had been sown and after that date, when the dry weather became settled, the surface soil was not in good condition for the sowing and germination

selected, having due regard to size and shape. From the roots, so selected, any branches or fangs, or portions thereof, of the thickness of an ordinary

Nitrate of Soda. Content of Roots. French Variety.	Nitrate of Soda. Content of Roots. German Variety.	Nitrate of Soda. Content of Roots. Wohanka Variety.	Not Top-Dressed. Average Yield per Statute Acre (Factory Weight). Danish Variety.	Dutch Variety.	French Variety.	German Variety.	Wohanka Variety.	Not Top-Dressed. Average Sugar Content of Roots. Danish Variety.	Dutch Variety.	French Variety.	German Variety.	Wohanka Variety.
%	%	%	T. C.	T. C.	T. C.	T. C.	T. C.	%	%	%	%	%
17·4	17·8	17·7	9 6	9 16	9 3	9 16	9 1	17·2	17·8	17·5	17·6	18·1
17·3	17·0	15·9	9 17	8 19	10 7	10 11	8 15	16·3	16·5	15·8	16·2	17·2
17·7	18·3	18·7	9 0	10 6	9 15	9 14	8 11	18·0	18·3	17·8	18·3	18·2
17·3	18·4	19·0	9 13	9 17	9 16	10 4	8 17	18·1	18·8	17·5	18·6	19·1
17·3	17·3	17·8	11 7	11 19	10 19	10 14	10 5	16·6	17·0	17·2	16·9	17·3
—	—	—	—	—	—	—	—	—	—	—	—	—
17·4	18·1	18·0	10 5	11 10	11 4	9 4	8 11	17·5	18·2	17·8	18·1	18·1
16·4	17·2	17·9	13 5	14 6	13 14	17 4	16 19	16·9	17·2	16·7	17·6	17·2
17·4	18·2	18·7	10 8	10 4	9 16	10 10	9 19	17·6	18·0	18·1	18·7	18·9
16·0	17·3	17·1	11 1	11 1	11 6	11 18	11 15	16·9	16·9	16·7	17·6	17·4
17·1	16·6	17·1	12 13	12 18	12 11	13 4	10 8	16·5	17·3	16·7	17·6	17·5
18·1	17·6	17·9	8 14	8 18	8 8	8 13	8 18	18·5	18·2	18·5	18·1	18·2
17·6	17·6	17·1	10 17	11 12	11 11	10 13	10 6	17·8	18·1	18·0	18·6	18·4
16·6	17·7	17·7	11 15	12 0	11 3	11 13	10 6	16·9	17·5	17·2	17·6	17·9
16·5	17·3	17·1	12 16	12 15	12 4	12 16	11 3	16·8	16·9	16·8	17·5	17·6
17·4	17·4	17·1	11 9	10 13	10 5	10 10	8 11	17·3	17·7	16·6	17·6	17·7
17·0	17·9	18·6	8 2	8 8	7 19	8 7	7 10	16·8	17·9	17·8	17·3	18·3
17·9	18·4	18·9	11 17	11 9	11 4	11 6	10 13	17·9	18·5	17·9	18·2	18·9
17·2	17·3	17·8	11 15	12 5	11 19	11 1	9 11	16·2	17·2	16·7	17·3	17·6
16·0	17·6	17·4	9 18	10 3	9 12	9 5	11 4	16·6	18·1	17·3	18·8	18·1
15·8	15·9	16·0	8 12	8 5	8 11	8 14	7 11	16·2	16·9	16·1	16·8	17·3
14·8	18·5	17·0	8 12	9 3	8 0	9 3	8 18	16·2	17·8	18·1	18·1	18·7
17·8	17·6	17·8	8 15	9 13	9 4	10 5	8 18	17·6	17·9	17·6	18·2	17·9
16·9	17·1	17·7	8 17	9 11	10 1	9 5	9 8	17·2	17·0	16·2	17·2	17·2
17·2	17·6	17·7	10 8	10 16	10 11	11 1	10 3	17·3	17·7	[illegible]	17·7	17·96
17·0	17·7	17·8	11 9	11 10	10 10	11 3	9 17	17·0	17·6	[illegible]	17·7	18·0
15·9	16·8	16·7	9 5	9 4	9 1	9 0	9 8	16·4	17·5	[illegible]	17·8	17·7
17·1	17·5	17·7	8 16	9 11	9 7	9 15	9 2	17·3	17·6	17·1	17·8	17·8
17·0	17·6	17·7	10 13	10 18	10 11	10 17·8	9 18	17·16	17·65	[illegible]	17·7	17·95

had been sown and after that date, when the dry weather became settled, the surface soil was not in good condition for the sowing and germination of beet seed. In fact, germination was irregular at most of the centres where land was prepared and the seed was sown during the second and third weeks of May, Seed sown at still later dates did not, as a rule, germinate until after the abundant rainfall between 5th and 18th June. With a single exception, all plots were sown before 1st June.

Singling and after-cultivation.

Singling of the crop at the majority of centres was carried out when the plants had developed four leaves exclusive of the two primary seed leaves. On the average, the plants reached this stage of growth within 6 or 7 weeks after the date of sowing but the average period between sowing and singling was extended to 9 weeks in the case of the 15 centres where the crop was sown in April. Under favourable conditions of weather and soil the beet crop should be ready for singling within about 5 weeks after sowing but in many cases wet weather in March and April interfered with the preparation of a fine seed bed; dry weather in May delayed germination of the seed; and very cool weather in June retarded growth of the braird. As a result the crop was not singled in a number of cases until 8 weeks or more after it was sown. The rather wet weather which prevailed throughout the period during which the crop required after-cultivation rendered the control of weeds somewhat difficult, but only a few cases were reported where the crop received inadequate attention as regards after-cultivation or the moulding up of the drills before the leaves met across the furrows.

Harvesting.

The most reliable indication of the ripeness of sugar beet when grown in this country is afforded by periodical analyses of specially selected samples of roots in order to determine the rate of increase in growth and in sugar content. For this purpose the Department carried out during the period from the end of August, 1927, to the middle of February, 1928, a series of fortnightly analyses of the 1927 crop on samples drawn from 16 centres representative of all parts of the Saorstat. The results of these analyses indicated that, as in previous years, favourable results might be expected by obtaining weighings and samples from the experimental plots during the month of November and it was, accordingly, decided to complete this work as far as possible during that month. The procedure adopted in ascertaining the yield of the crop on the various sub-plots was as follows:—

An area of two statute perches representative of the general crop on each sub-plot was accurately measured off. The beets were lifted by hand, with the aid of a fork where necessary. Those which had bolted or were abnormally small were discarded. All loosely adhering soil was removed by scraping the roots with the back of the topping knife, after which the leaves and crown were cut off squarely at the point where the lowest leaf had originally appeared. When the roots from the measured area of two statute perches were scraped and topped, one quarter, by weight, of the roots was

selected, having due regard to size and shape. From the roots, so selected, any branches or fangs, or portions thereof, of the thickness of an ordinary lead pencil were cut off, after which each root was thoroughly cleaned by washing and scrubbing. From the weight of such washed roots the "factory weight" for the produce of the whole sub-plot was then calculated.

After the roots had been weighed to ascertain the yield, a thoroughly representative sample consisting of from six to nine of the topped and washed roots from each sub-plot was despatched to the State Laboratory in Dublin, where, immediately after arrival, each sample was analysed for sugar content in accordance with the usual practice adopted by beet sugar factories.

Of the 139 centres where experiments were laid down complete results were obtained from 127 centres. At 84 of these centres a top-dressing of itrate of soda at the rate of 1 cwt. per statute acre was applied to one half f each sub-plot in accordance with the conditions of the scheme as already et out. At 32 other centres, where the crop was backward in growth or here it was thought that the attacks of mangel fly were likely to interfere with the development of the crop, a top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre was applied to the entire plot. At the remaining 11 centres supplies of nitrate of soda were not available and, consequently no top-dressing was applied to any portion of the plots.

From 12 centres at which the experiments were conducted complete results were not obtained for the following reasons:—

At one centre in County Leitrim the soil was heavy and retentive and, owing to the wet season, the crop failed to such extent that no weighings or samples were taken. The crops on the plots at 3 centres located in Offaly, Meath and Longford were so irregular and patchy that it was impossible to obtain reliable weighings from the different sub-plots. At one centre in Mayo and at two centres in Galway reliable results were not obtained owing to errors in the cultivation of the crop. At three centres in Roscommon, Galway and Cavan, respectively, the crops grown on the experimental plots were lifted before weighings and samples could be obtained. At one centre in Kerry and at another in Monaghan the crop failed largely through neglect of cultivation and reliable records could not be obtained from the different sub-plots.

Detailed particulars in respect of:—

(*a*) the centres where only half of each plot was top-dressed with nitrate of soda at the rate .. 1 cwt. per statute acre.

(*b*) the centres where the entire plot was top-dressed with nitrate of soda at the rate of 1 cwt. per statute acre.

(*c*) the centres where a top-dressing of nitrate of soda was not applied, are shown in Tables II, III and IV, respectively, appearing in a report which has been issued as a separate publication, and of which copies may be obtained on application to the Department.

Summaries of the results appearing in Tables II and III are shown in Tables V and VI, respectively.

TABLE VI.

SHOWING AVERAGE RETURNS FOR EACH COUNTY AND PROVINCE IN RESPECT OF CENTRES WHERE THE ENTIRE PLOT WAS TOP-DRESSED WITH NITRATE OF SODA.

PROVINCE	COUNTY	No. of Centres	Average Yield per Statute Acre (Factory Weight)					Average Sugar Content of Roots				
			Danish Variety	Dutch Variety	French Variety	German Variety	Wohanka Variety	Danish Variety	Dutch Variety	French Variety	German Variety	Wohanka Variety
			T. C.	T. C.	T. C.	T. C.	T. C.	%	%	%	%	%
LEINSTER—												
	CARLOW ...	—	—	—	—	—	—	—	—	—	—	—
	DUBLIN ...	—	—	—	—	—	—	—	—	—	—	—
	KILDARE ...	—	—	—	—	—	—	—	—	—	—	—
	KILKENNY ...	—	—	—	—	—	—	—	—	—	—	—
	LAOIGHIS ...	—	—	—	—	—	—	—	—	—	—	—
	LONGFORD ...	—	—	—	—	—	—	—	—	—	—	—
	LOUTH ...	3	10 11	10 7	10 0	9 15	8 4	17·8	17·6	17·0	17·7	16·9
	MEATH ...	—	—	—	—	—	—	—	—	—	—	—
	OFFALY ...	—	—	—	—	—	—	—	—	—	—	—
	WESTMEATH ...	—	—	—	—	—	—	—	—	—	—	—
	WEXFORD ...	—	—	—	—	—	—	—	—	—	—	—
	WICKLOW ...	—	—	—	—	—	—	—	—	—	—	—
MUNSTER—												
	CLARE ...	2	9 11	8 15	10 1	7 12	8 0	16·7	17·3	16·4	17·9	16·3
	CORK	4	9 15	9 15	9 0	9 10	8 13	17·1	17·6	16·7	17·4	17·7
	KERRY	3	15 8	14 17	13 8	13 18	12 16	16·9	17·9	16·9	17·5	17·0
	LIMERICK ...	4	14 19	14 6	14 17	15 8	14 3	16·7	17·3	16·7	17·3	17·6
	TIPPERARY, N.R.	—	—	—	—	—	—	—	—	—	—	—
	TIPPERARY, S.R.	—	—	—	—	—	—	—	—	—	—	—
	WATERFORD ...	—	—	—	—	—	—	—	—	—	—	—
CONNAUGHT—												
	GALWAY ...	2	12 4	12 18	14 13	11 13	14 3	17·2	17·7	15·9	17·0	18·0
	LEITRIM ...	1	10 0	9 5	9 5	11 8	8 11	18·0	17·9	16·2	15·8	16·7
	MAYO	7	9 18	9 18	9 18	10 5	9 19	16·9	17·5	16·6	17·2	17·2
	ROSCOMMON ...	3	8 19	10 10	11 12	11 3	11 17	15·9	17·4	16·4	17·2	17·2
	SLIGO	1	14 19	14 8	14 2	13 13	11 19	16·2	15·7	16·1	16·7	16·0
ULSTER—												
	CAVAN	2	6 0	5 14	7 3	6 0	5 17	16·8	17·1	16·1	17·5	17·8
	DONEGAL ...	—	—	—	—	—	—	—	—	—	—	—
	MONAGHAN ...	—	—	—	—	—	—	—	—	—	—	—
PROVINCIAL AVERAGES—												
	LEINSTER ...	3	10 11	10 7	10 0	9 15	8 4	17·8	17·6	17·0	17·7	16·9
	MUNSTER ...	13	12 12	12 3	11 19	12 1	11 4	16·8	17·5	16·7	17·5	17·3
	CONNAUGHT ...	14	10 8	10 15	11 4	10 19	11 0	16·7	17·4	16·4	17·0	17·2
	ULSTER ...	2	6 0	5 14	7 3	6 0	5 17	16·8	17·1	16·1	17·5	17·8
AVERAGES FOR AN SAORSTAT ...		32	11 1	10 19	11 3	10 19	10 10	16·9	17·4	16·5	17·3	17·2

PLAN OF EXPERIMENTS

at the Department's Farms at Athenry, Ballyhaise and Clonakilty and at the Albert Agricultural College, Glasnevin (University College, Dublin).

Farmyard Manure applied in Spring.		Farmyard Manure applied in Winter.	
Wohanka Variety.	6 Drills ...	... 3 cwt. of Nitrate of Soda in 3 separate dressings.	Variety and Top-dressing Experiments.
	6 ,, ...	... 2 ,, ,, ,, 2 ,, ,,	
	6 ,, ...	... 1 ,, ,, ,, 1 dressing.	
	6 ,, ...	... Not top-dressed.	
Horning Variety.	6 ,, ...	... 3 cwt. of Nitrate of Soda in 3 separate dressings.	
	6 ,, ...	... 2 ,, ,, ,, 2 ,, ,,	
	6 ,, ...	... 1 ,, ,, ,, 1 dressing.	
	6 ,, ...	... Not top-dressed.	
German Variety.	6 ,, ...	... 3 cwt. of Nitrate of Soda in 3 separate dressings.	
	6 ,, ...	... 2 ,, ,, ,, 2 ,, ,,	
	6 ,, ...	... 1 ,, ,, ,, 1 dressing.	
	6 ,, ...	... Not top-dressed.	
Dutch Variety.	6 ,, ...	... 3 cwt. of Nitrate of Soda in 3 separate dressings.	
	6 ,, ...	... 2 ,, ,, ,, 2 ,, ,,	
	6 ,, ...	... 1 ,, ,, ,, 1 dressing.	
	6 ,, ...	... Not top-dressed.	
Artificial Manures applied at Different Seasons.	6 ,, ...	... Equivalent of 4 cwt. 35% Super., in form of Basic Slag, applied in Winter. 4 cwt. Kainit, applied in Spring. 1 cwt. Sulphate of Ammonia, applied in Spring.	Manurial and Cultivation Experiments.
	6 ,, ...	... 4 cwt. Super. 35%, applied at time of Sowing. 4 cwt. Kainit, applied in Winter. 1 cwt. Sulphate of Ammonia, applied at time of Sowing.	
	6 ,, ...	... Equivalent of 4 cwt. 35% Super., in the form of Basic Slag, applied at time of Sowing. 4 cwt. Kainit, applied at time of Sowing. 1 cwt. Sulphate Ammonia, applied at time of Sowing.	
	6 ,, ...	... 4 cwt. Super. 35%, applied at time of Sowing. 4 cwt. Kainit, applied at time of Sowing. 1 cwt. Sulphate Ammonia, applied at time of Sowing.	
	6 ,, ...	... 4 cwt. Super 35%, applied at time of Sowing. 4 cwt. Kainit, applied at time of Sowing. 2 cwt. Sulphate Ammonia, applied at time of Sowing.	
Width of Drills.	6 ,, ...	... 21″ Drills. Singled, 9″ apart.	
	6 ,, ...	... 24″ Drills. ,, 9″ ,,	
	6 ,, ...	... 18″ Rows or Drills. ,, 9″ ,,	
Singling at Different Distances Apart.	3 ,, ...	... 18″ Rows or Drills. Singled, 8″ apart.	
	3 ,, ...	... 18″ ,, ,, 12″ ,,	
	3 ,, ...	... 24″ Drills. ,, 8″ ,,	
	3 ,, ...	... 24″ ,, ,, 12″ ,,	
	3 ,, ...	... 21″ ,, ,, 8″ ,,	
	3 ,, ...	... 21″ ,, ,, 12″ ,,	
Singling at Different Stages of Growth	6 ,, ...	... 21″ Drills. Singled a week or 10 days before normal date of thinning.	
	6 ,, ...	... 21″ Drills. Singled at the normal season.	
	6 ,, ...	... 21″ Drills. Singled a week or 10 days later than normal date of thinning.	
Methods of Cultivation.	6 ,, ...	... 21″ Drills. Cultivated better than ordinary crop.	
	6 ,, ...	... 21″ Drills. Cultivated not so well as the ordinary crop.	
Farmyard Manure applied in Spring.		Farmyard Manure applied in Winter.	

The results shown in the tables were obtained from 127 centres at which 1,055 sub-plots were laid down. The returns from these 1,055 sub-plots show that the average yield was 10 tons 17 cwt. (factory weight) of beet per statute acre and that the average sugar content of the samples was 17·4 per cent. The Dutch and German varieties were on the average exactly equal both as regards yield and sugar content and were superior in both respects to the Danish and French varieties. The Wohanka variety produced on the average a lower yield than any of the other varieties but in sugar content it was slightly superior to even the Dutch and German varieties. A comparison of the yields obtained from the sub-plots at each centre where the trials were conducted shows that the highest yield was produced by either the Dutch or German varieties at 59 per cent. of the total number of centres from which results were obtained and that as in the case of the average yield from all sub-plots the Dutch and German varieties were superior to all other varieties in an equal number of cases. A similar comparison of the returns from the 211 series of sub-plots in regard to the sugar content of the five varieties shows that in 88 per cent. of the total number of cases the highest sugar content was obtained from either the Dutch, German or Wohanka varieties. Taking the combined average results in regard to both yield and sugar content the Dutch and German varieties were exactly equal and were distinctly superior to each of the other three varieties. Although the difference in the returns produced by the French, Danish and Wohanka varieties is not very marked the Wohanka variety produced the poorest results.

Effects of Top-dressing.

From the results at the centres where half of each plot was top-dressed with nitrate of soda at the rate of 1 cwt. per statute acre, it will be observed that the average yield from the top-dressed sub-plots exceeded that obtained from the sub-plots which were not top-dressed by approximately 9 cwt. per statute acre. On the other hand, the average sugar content of the samples from all sub-plots which were not top-dressed was 0·14 per cent. higher than the average sugar content of the samples from the corresponding sub-plots which were top-dressed. This difference in sugar content is, however, so slight that it can hardly be regarded as significant. A comparison of the average returns from each centre in respect of the sub-plots which were top-dressed with nitrate of soda and those which were not top-dressed shows that at approximately 20 per cent. of the centres the top-dressing had the effect of increasing the average yield by one ton or more and that in approximately an equal number of cases the average sugar content of the beet grown on the sub-plots which received no top-dressing was at least 0·5 per cent. higher than the sugar content of the beet grown on the adjoining top-dressed plots. On the other hand at about 25 per cent. of the centres where half of each plot was top-dressed with nitrate of soda the top-dressing had no appreciable effect on the yield and at an equal number of centres it had no marked influence on the sugar content. From a study of these results it is evident that a top-dressing of nitrate of soda at the rate of one cwt. per statute acre is not likely to lower the sugar content of the beet to any

appreciable extent. It is also evident that the increased yield resulting from such a top-dressing depends largely upon the condition of the soil and the growth of the crop at the time of application. In unfavourable seasons or under adverse conditions, as for example, where the crop is attacked by pests or diseases, a top-dressing of nitrate of soda may be the means of carrying the plants over a critical period in the early stages of growth.

Influence of place in rotation.

At the 127 centres from which complete returns were received the sugar beet was grown after a corn crop at 74 centres and after potatoes or a manured root crop at 53 centres. From the results of these experiments no definite conclusion can be formed as to the influence of the preceding crop on the yield or sugar content of the beet. It is evident, however, that sugar beet can be grown successfully in a variety of positions in the rotation, and it is probable that the practice of growing beet after lea oats in the position usually occupied by the root crop will be generally adopted where beet is grown as an ordinary farm crop.

Soils.

At the great majority of centres at which the experiments were conducted the soil was described as loam or medium loam. At a considerable number of centres the soils were heavy or clay loams. At 14 centres the soil was said to be of a moory or peaty nature, and at 9 centres the soils were described as light or sandy loams. Although the average yield from the crops grown at centres where the soil was described as peaty was lower than the average yield in respect of all centres, the average sugar content of the crops at these particular centres was up to the general average. Of the different types of soils on which beet was grown the best returns, both as regards yield and sugar content, were obtained on the lighter types of soils. The cool wet weather which prevailed throughout the greater part of the season was particularly favourable to these types of soils. It is evident however, from the results of these experiments that satisfactory crops of sugar beet, both as regards yield and sugar content, can be produced on almost any type of soil which may be regarded as suitable for ordinary tillage crops provided, of course, that due attention is paid to manuring and cultivation.

Manuring.

At the centres where farmyard manure was applied directly to the sugar beet crop it was ploughed in during the winter at 14 centres, and at the remaining centres it was applied in the drills immediately before the seed was sown. Owing to the small number of centres at which farmyard manure

was applied in winter it is not possible to draw conclusions as to the effect of this practice on the yield and sugar content of the crop. From the reports received it would appear that the shape of the roots was not adversely affected where the farmyard manure was applied in the drills.

At 20 of the centres where the beet followed a root crop or potatoes and was grown on artificial manures only, the results, both as regards yield and sugar content, were quite satisfactory. At the 8 centres where the beet was grown after a corn crop and was manured with artificials only the average yield was slightly below the general average. At four centres where the prescribed mixture of artificial manure was applied at the rate of 14 cwt, per statute acre yields well above the average were obtained but the sugar content of the roots was below average. At the two centres where seaweed was applied in place of farmyard manure satisfactory results were obtained,

Bolting and Forking.

Although bolting did not occur to the same extent as in 1926 the returns for the 1927 crop afford further evidence that bolting is influenced by the date of sowing and by subsequent weather conditions. Bolting was most prevalent in the case of the crops which were sown very early in the season and where growth was, owing to weather conditions, subsequently retarded, whereas the crops sown late in the season were comparatively free from bolted plants. At most centres the Wohanka variety produced a much greater number of bolted plants than any of the other varieties tested. The French variety also produced a large proportion of bolted plants. Although the German and Danish varieties produced a number of " bolters " at most centres the proportion of bolted plants was not nearly so great as in the case of the other two varieties mentioned above. The Dutch variety, on the whole, produced a very small proportion of bolted plants and as regards bolting it is evident that this variety is distinctly superior to the other varieties included in these trials.

In nearly all cases the shape of the roots was satisfactory but at a number of centres a rather large proportion was forked—a defect which involves loss to both the grower and the factory. The experiments provide some evidence that forking may be associated with soils of the heavy, peaty and gravelly types. On the other hand, the results indicate that the application of well rotted farmyard manure in the drills immediately before sowing did not result in the production of an undue proportion of forked roots.

Pests and Diseases.

Mangel fly was again the only pest which was at all prevalent during the past season. The fly attacked the crop at 60 centres, but from only 2 centres

was it reported that the returns from the crop were materially reduced as a result of the attack.

Although the weather was rather favourable for the development of fungoid diseases affecting the leaves of sugar beet no serious damage of this nature was reported. Phoma, or crown rot, was reported as having caused slight damage at only four centres.

Manurial Experiments.

In view of the general practice regarding the manuring of the sugar beet and mangel crops, it was decided, in the case of the sugar beet experiments conducted by the Department in 1925, that the manurial dressing per statute acre to be applied to all experimental plots should be as follows :—

12 tons farmyard manure.
4 cwt. superphosphate (35%)
4 cwt. kainit.
1 cwt. sulphate of ammonia.

The above mixture of artificial manures gave such satisfactory results when applied to the experimental plots in 1925 that it was adopted as the standard manurial dressing for both experimental and commercial crops of sugar beet grown in 1926 and 1927. In order, however, to determine whether this standard dressing of artificial manures or some modification thereof was likely to give the most satisfactory results when applied to sugar beet, it was decided to conduct in 1926 a series of manurial trials with various mixtures of artificial manures. The results of these manurial trials were included in a report on the sugar beet experiments in 1926 which was published in the Department's Journal, Vol. XXVII, No. 1, and also in leaflet form.

A somewhat similar series of manurial trials with various mixtures of artificial manures was carried out in 1927. As in the previous year, these trials were confined to Counties Carlow, Kildare, Kilkenny, Laoighis, Offaly, Tipperary (N.R.), Waterford, Wexford and Wicklow, where the bulk of the supplies of sugar beet for the Carlow factory were grown. These experiments were conducted at four centres in each county, except County Wicklow where the trials were carried out at only two centres. The plots were laid down at almost all centres on land which in the previous season had been cropped with lea oats. At all centres a dressing of farmyard manure was applied uniformly at the rate of 12 tons per statute acre, either during the winter before the land was ploughed or in the drills in the spring. At each centre five-eighths of a statute acre was divided into ten uniform plots, each

comprising five drills. The following dressings of artificial manures were applied to the respective plots at each centre :—

PLOT	MANURES	
I.	3 cwt. superphosphate (35%) 4 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
II.	5 cwt. superphosphate (35%) 4 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
III.	6 cwt. superphosphate (35%) 4 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
IV.	4 cwt. superphosphate (35%) 3 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
V.	4 cwt. superphosphate (35%) 5 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
VI.	4 cwt. superphosphate (35%) 4 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
VII.	4 cwt. superphosphate (35%) 4 ,, kainit 2 ,, sulphate of ammonia	per statute acre.
VIII.	4 cwt. superphosphate (35%) 4 ,, kainit Calcium cyanamide sufficient to supply the same quantity of Nitrogen as is contained in one cwt. of sulphate of ammonia.	per statute acre.
IX.	4 cwt. superphosphate (35%) 4 ,, kainit 1 ,, nitrate of soda	per statute acre.
X.	4 cwt. superphosphate (35%) 4 ,, kainit 2 ,, nitrate of soda	per statute acre.

The artificial manures were applied immediately before the seed was sown, except in the case of Plots IX and X, to which the nitrate of soda was applied

as a top-dressing. Plot IX received a top-dressing at the rate of 1 cwt. per statute acre, immediately after the crop was singled, and plot X received a similar top-dressing at the same time. In addition, the latter plot received a second top-dressing at the same rate a week or two later.

The Dutch variety of seed which was included in the variety trials was sown at all centres where the Manurial Trials were carried out.

The general cultivation of the crop on these plots was the same as in the case of the variety trials already referred to. Throughout the growing season very little difference was noted at most centres in the appearance of the crop on the various sub-plots except that in the case of Plots II and III, which received the dressings of 5 and 6 cwts. respectively of superphosphate, Plot VII, which received the dressing of 2 cwt. of sulphate of ammonia, and Plot X, which received the dressing of 2 cwt. of nitrate of soda per statute acre, the growth of foliage was, as a rule, somewhat more vigorous throughout the growing season than in the case of the other plots. It was reported that at the time when weighings were taken for the determination of yield there was very little outward indication of ripeness of the crop on any of the plots, and at the majority of the centres this was particularly noticeable in the case of Plots VII and X which received the heavier dressings of nitrogenous manures.

The procedure adopted with regard to the weighing, sampling and analysis of the produce of these plots was the same as in the case of the variety trials conducted by the Agricultural Instructors except that plants which had bolted were included in the quantities weighed for the determination of the yield.

Of the 34 centres at which experiments were laid down complete returns are available from 31 centres. Reliable returns could not be obtained from three centres where the crop was very patchy.

Detailed particulars in respect of the 31 centres from which complete returns were obtained are shown in Table VII.

[Table.

The average returns from the different plots at all centres are rather remarkably uniform both as regards yield and sugar content of the beet. There is an indication, however, that the heavier dressings of superphosphate, kainit and nitrogen (in the form of sulphate of ammonia and nitrate of soda) had, on the average, a tendency to slightly increase the yield. The returns at all centres from Plot VIII which received a dressing containing calcium cyanamide and from Plot VI which received an equivalent quantity of nitrogen in the form of sulphate of ammonia show that, on the average, better results as regards both yield and sugar content were obtained from Plot VI. This result is confirmed by the fact that at 70 per cent. of the total number of centres the yield from Plot VI was greater than the yield from Plot VIII. It is worthy of note that having regard to the quantity of artificial manures applied to each plot the dressing which contained nitrogen in the form of calcium cyanamide produced relatively poorer returns than any of the other dressings of artificial manure.

The differences in the average sugar content of the beet from the plots at the various centres are so slight that no definite conclusions should be drawn as to the influence of the different manurial dressings on the sugar content.

Having regard, however, to the results obtained from the plots to which the standard dressing of 4 cwt. superphosphate, 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre was applied, it is evident that this mixture can be relied upon to give satisfactory returns on most soils, and pending the results of further manurial trials, the Department have recommended the use of this mixture, supplemented, where necessary, by a top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre.

II.—EXPERIMENTS AT THE DEPARTMENT'S FARMS AND AT THE ALBERT AGRICULTURAL COLLEGE (UNIVERSITY COLLEGE, DUBLIN).

During the season of 1927 experiments with sugar beet were conducted at the Department's Farms at Athenry, Ballyhaise and Clonakilty and also at the Albert Agricultural College, Glasnevin, to determine the effects of :—

(1) Application of farmyard manure in winter and in spring.

(2) Top-dressing with nitrate of soda at rates in excess of 1 cwt. per statute acre applied to four varieties of sugar beet.

(3) Application of artificial manures at different seasons.

(4) Sowing of the crops in rows or drills of different widths.

(5) Singling of the plants to different distances apart.

(6) Singling of the crop at different stages of growth.

(7) Neglect of timely and thorough after-cultivation of the crop.

Experiments were also conducted on the farm at The Munster Institute, Cork, with the object of determining the effects of varying quantities of phosphates on the ripening of the crop.

Experiments at Athenry, Ballyhaise, Clonakilty and Glasnevin Farms.

On the Continent where sugar beet is extensively cultivated the general practice is to apply the farmyard manure in autumn or winter as it is generally believed that the application of the manure immediately before sowing encourages the production of forked or badly shaped roots. With a view to testing the effects of applying farmyard manure to the sugar beet crop in winter and in the drill in spring experiments were conducted at three centres in 1926. The results of these trials which were published in the Department's Journal, Vol. XXVII No. 1, indicated generally that the time of year at which the farmyard manure was applied to the beet crop did not appear to exercise any appreciable influence on the shape of the roots produced or on the yield and sugar content of the beet. In view, however, of the relatively small number of centres at which these experiments were conducted in 1926 it was decided to repeat the tests at four centres in 1927.

The experiments conducted at the above-mentioned centres in 1927 were arranged as shown on the plan facing page 44 which is exactly the same as the plan of the previous year's experiments. The procedure adopted in laying down the experiments at each centre was as follows :—

A rectangular plot of lea oat stubble ground measuring 116 yards by 84 yards, *i.e.*, approximately two statute acres, was marked off at each centre. This plot was divided into two equal portions by a line parallel to the longer dimension, and one portion was dressed with farmyard manure at the rate of 15 tons per statute acre before the land was ploughed in winter. A similar quantity of farmyard manure was stored over winter in a heap in the open, and was applied to the other portion of the plot in the drills before sowing. In order to ensure that both plots would receive farmyard manure of the same quality, it was arranged at each centre that, as the manure was being carted out on to the plot which was being manured in winter, every alternate load should be placed in a heap adjacent to the corresponding plot to be dressed with farmyard manure in spring. The heap when completed was compactly built so as to prevent undue losses through exposure to the weather and, before the manure was applied in spring, it was re-weighed in order to determine the loss in weight during storage. The shrinkage in weight at each centre was found to be as follows :—

Athenry	12%
Ballyhaise	18%
Clonakilty	22%
Glasnevin	23%

In preparing the land for the sowing of the seed, which, with the exception of variety trials, was of the Dutch (Kuhn & Co. P.) variety, the drills were made across both plots, and the farmyard manure stored over winter was applied to the plot which had been reserved for that purpose. On the adjoining plots to which farmyard manure had been applied either in winter or in spring, the various tests, as previously described and as shown in the plan facing page 44, were carried out in duplicate.

Varieties and Top-dressing.

One acre at each centre, half of which had received a dressing of farmyard manure in winter and the other half in spring, was set aside for top-dressing trials with four varieties, viz. :—Dutch ("Kuhn & Co. P.") German ("Klein Wanzleben Original Z") Horning ("H. S.") and Wohanka. To each of these one-acre plots a dressing of artificial manures, consisting of 4 cwt. superphosphate (35%), 4 cwt. kainit and 1 cwt. sulphate of ammonia, was applied at the time of sowing. At all centres the drills were 21 inches in width, and the seed was dibbled in by hand to allow exactly 9 inches between the plants when singled. On the one-acre plot at each centre, 24 drills were sown with each of the four varieties of seed, and the area under each variety was divided into four sub-plots, each comprising six drills. These sub-plots were arranged as shown on the plan, to which reference has already been made.

One sub-plot of each variety received no top-dressing. The other three sub-plots received a top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre, immediately after singling. Two sub-plots received a second dressing of nitrate of soda, at the same rate, about 14 days after the first top-dressing was applied, and one sub-plot received a third top-dressing, at the same rate, about a fortnight after the second top-dressing was applied.

Apart from the extra top-dressing of nitrate of soda, the plots sown with the different varieties of seed were treated in exactly the same manner as the similar plots laid down in the previous year. The general cultivation, weighing, sampling and analyses of the crop on these plots were the same as in the case of the variety trials carried out by the Agricultural Instructors already described in this report. At the Ballyhaise centre where the soil is very stiff and heavy, the seed did not germinate evenly, with the result that the crop remained somewhat patchy throughout the season. At Glasnevin, where the sowing of the seed coincided with a spell of dry harsh weather, the braird was somewhat irregular, and growth was retarded to such an extent that singling was unduly delayed. Later in the season, however, the crop made good progress. At the other two centres the crop on all the plots developed normally, and at no centre were the plants injured to any serious extent by pests, or diseases. At the Athenry and Ballyhaise centres the plants on the plots to which farmyard manure had been applied in autumn, presented a slightly better appearance, and appeared to have developed more foliage than the plants on the corresponding plots to which farmyard manure was applied in spring. From Glasnevin centre it was reported that the braird on the plot to which farmyard manure was applied in the autumn, was more uniform than that on the plot which was manured in spring.

At all four centres both the Wohanka and Horning varieties produced a greater number of bolters than the other two varieties, the Wohanka being the worst in this respect.

The dates of sowing, singling and application of the top-dressing of nitrate of soda, together with particulars as to the yield and sugar content of the beet on the various sub-plots at each centre which received farmyard manure in

winter, and on the corresponding sub-plots to which farmyard manure was applied in spring, are shown in Tables VIII. and IX., respectively.

TABLE VIII.

Returns from Plots to which Farmyard Manure was applied in Winter.

Centre.	Date of Sowing	Date of Singling	Dates of application of top-dressing of Nitrate of Soda.			Not Top-dressed.							
						Yield per Statute Acre (Factory Weight).				Sugar Content of Roots.			
			1st Application	2nd Application	3rd Application	Wohanka Variety	Horning Variety	German Variety	Dutch Variety	Wohanka Variety	Horning Variety	German Variety	Dutch Variety
						T. C.	T. C.	T. C.	T. C.	%	%	%	%
Athenry	21-5-27	12-7-27	29-7-27	9-8-27	20-8-27	10 1	10 13	8 13	9 6	17·7	16·6	17·5	18·1
Ballyhaise	19-5-27	7-7-27	12-7-27	19-7-27	19-7-27	5 18	6 3	7 6	6 15	17·2	17·1	17·2	17·0
Clonakilty	5-5-27	14-6-27	24-6-27	8-7-27	22-7-27	13 6	12 11	14 7	14 11	15·2	16·9	16·6	17·9
Glasnevin	11-5-27	23-6-27	24-6-27	—	—	10 10	8 1	7 3	10 3	14·3	15·9	16·4	15·5
Average (Four Centres) ...						9 19	9 7	9 7	10 4	16·1	16·6	16·9	17·1

Centre.	Date of Sowing	Date of Singling	Dates of application of top-dressing of Nitrate of Soda.			Top-dressed with 1 Cwt. Nitrate of Soda per Statute Acre.							
						Yield per Statute Acre (factory weight).				Sugar Content of Roots.			
			1st Application	2nd Application	3rd Application	Wohanka Variety	Horning Variety	German Variety	Dutch Variety	Wohanka Variety	Horning Variety	German Variety	Dutch Variety
						T. C.	T. C.	T. C.	T. C.	%	%	%	%
Athenry	21-5-27	12-7-27	29-7-27	9-8-27	20-8-27	9 16	10 11	9 6	8 18	17·4	16·4	16·6	16·9
Ballyhaise	19-5-27	7-7-27	12-7-27	19-7-27	19-7-27	6 0	6 11	7 4	7 0	17·1	16·8	17·5	18·2
Clonakilty	5-5-27	14-6-27	24-6-27	8-7-27	22-7-27	13 9	16 3	14 18	15 17	16·8	16·7	16·8	18·7
Glasnevin	11-5-27	23-6-27	24-6-27	—	—	11 5	12 13	6 18	9 6	14·5	13·8	16·4	16·0
Average (Four Centres) ...						10 2	11 9	9 11	10 5	16·5	15·9	16·8	17·5

Centre.	Date of Sowing	Date of Singling	Dates of application of top-dressing of Nitrate of Soda.			Top-dressed with 2 Cwt. Nitrate of Soda per Statute Acre, applied in Two Separate Dressings.							
						Yield per Statute Acre (factory weight).				Sugar Content of Roots.			
			1st Application	2nd Application	3rd Application	Wohanka Variety	Horning Variety	German Variety	Dutch Variety	Wohanka Variety	Horning Variety	German Variety	Dutch Variety
						T. C.	T. C.	T. C.	T. C.	%	%	%	%
Athenry	21-5-27	12-7-27	29-7-27	9-8-27	20-8-27	10 1	10 0	10 1	9 1	17·1	17·5	17·4	17·3
Ballyhaise	19-5-27	7-7-27	12-7-27	19-7-27	19-7-27	8 8	7 4	7 10	7 0	16·2	16·8	16·6	16·8
Clonakilty	5-5-27	14-6-27	24-6-27	8-7-27	22-7-27	3 9	14 11	14 7	15 9	16·0	16·8	17·0	16·8
Glasnevin	11-5-27	23-6-27	24-6-27	—	—	11 9	12 14	8 9	6 11	15·5	15·0	16·0	14·6
Average (Four Centres) ...						10 17	11 2	10 2	9 10	16·2	16·5	16·8	16·4

TABLE VIII.—continued.

Centre.	Date of Sowing	Date of Singling	Dates of application of top-dressing of Nitrate of Soda.			Top-dressed with 3 Cwt. Nitrate of Soda per Statute Acre, applied in Three Separate Dressings.							
						Yield per Statute Acre (Factory Weight).				Sugar Content of Roots.			
			1st Application	2nd Application	3rd Application	Wohanka Variety	Horning Variety	German Variety	Dutch Variety	Wohanka Variety	Horning Variety	German Variety	Dutch Variety
						T. C.	T. C.	T. C.	T. C.	%	%	%	%
Athenry	21-5-27	12-7-27	29-7-27	9-8-27	20-8-27	9 11	10 16	10 0	8 1	17·4	14·8	16·1	15·9
Ballyhaise	19-5-27	7-7-27	12-7-27	19-7-27	26-7-27	7 10	6 19	7 2	7 5	15·6	16·8	17·0	17·5
Clonakilty	5-5-27	14-6-27	24-6-27	8-7-27	22-7-27	12 17	13 3	14 4	15 3	16·4	15·7	17·4	17·9
Glasnevin	11-5-27	23-6-27	24-6-27	—	—	9 10	11 17	7 11	7 0	15·5	15·9	15·8	15·5
Average (Four Centres) ...						9 17	10 11	9 14	9 7	16·2	15·8	16·8	16·7

TABLE IX.

Returns from Plots to which Farmyard Manure was applied in Spring.

Centre.	Date of Sowing	Date of Singling	Dates of application of top-dressing of Nitrate of Soda.			Not Top-dressed.							
						Yield per Statute Acre (factory weight).				Sugar Content of Roots.			
			1st Application	2nd Application	3rd Application	Wohanka Variety	Horning Variety	German Variety	Dutch Variety	Wohanka Variety	Horning Variety	German Variety	Dutch Variety
						T. C.	T. C.	T. C.	T. C.	%	%	%	%
Athenry	21-5-27	12-7-27	29-7-27	9-8-27	20-8-27	9 14	9 1	7 0	7 7	17·3	17·9	17·7	17·1
Ballyhaise	19-5-27	7-7-27	12-7-27	19-7-27	26-7-27	6 10	6 0	5 14	6 12	17·3	16·9	16·6	16·1
Clonakilty	5-5-27	14-6-27	24-6-27	8-7-27	22-7-27	13 18	14 7	13 6	15 3	16·6	17·5	18·0	17·3
Glasnevin	11-5-27	23-6-27	24-6-27	—	—	7 17	12 7	9 8	11 11	15·7	16·5	15·9	14·7
Average (Four Centres) ...						9 10	10 9	8 17	10 3	16·7	17·2	17·0	16·3

Centre.	Date of Sowing	Date of Singling	Dates of application of top-dressing of Nitrate of Soda.			Top-dressed with 1 Cwt. Nitrate of Soda per Statute Acre.							
						Yield per Statute Acre (factory weight).				Sugar Content of Roots.			
			1st Application	2nd Application	3rd Application	Wohanka Variety	Horning Variety	German Variety	Dutch Variety	Wohanka Variety	Horning Variety	German Variety	Dutch Variety
						T. C.	T. C.	T. C.	T. C.	%	%	%	%
Athenry	21-5-27	12-7-27	29-7-27	9-8-27	20-8-27	8 13	8 10	7 1	7 11	17·9	17·0	16·4	16·3
Ballyhaise	19-5-27	7-7-27	12-7-27	19-7-27	26-7-27	6 3	7 1	7 13	8 0	16·4	16·0	16·2	16·4
Clonakilty	5-5-27	14-6-27	24-6-27	8-7-27	22-7-27	13 13	14 9	14 11	15 13	16·1	17·1	17·8	18·0
Glasnevin	11-5-27	23-6-27	24-6-27	—	—	7 11	11 14	8 3	11 5	14·8	15·3	15·6	15·7
Average (Four Centres) ...						9 0	10 8	9 7	10 12	16·3	16·8	16·5	16·6

TABLE IX.—continued.

Centre.	Date of Sowing	Date of Singling	Dates of application of top-dressing of Nitrate of Soda.			Top-dressed with 2 Cwt. Nitrate of Soda per Statute Acre, applied in Two Separate Dressings.							
						Yield per Statute Acre (factory weight).				Sugar Content of Roots.			
			1st Application	2nd Application	3rd Application	Wohanka Variety	Horning Variety	German Variety	Dutch Variety	Wohanka Variety	Horning Variety	German Variety	Dutch Variety
						T. C.	T. C.	T. C.	T. C.	%	%	%	%
Athenry ·	25-5-27	12-7-27	29-7-27	9-8-27	20-8-27	8 0	9 7	8 13	7 16	17·3	17·7	17·5	16·3
Ballyhaise ·	19-5-27	7-7-27	12-7-27	19-7-27	26-7-27	7 15	7 9	7 10	7 0	16·2	16·9	16·3	15·9
Clonakilty ·	5-5-27	14-6-27	24-6-27	8-7-27	22-7-27	13 16	13 14	14 0	16 1	16·7	15·0	17·0	17·3
Glasnevin ·	11-5-27	23-6-27	24-6-27	—	—	8 18	7 17	10 10	9 13	15·2	15·5	16·5	15·7
Average (Four Centres) ...						9 12	9 12	10 3	10 2	16·3	16·3	16·8	16·3

Centre.	Date of Sowing	Date of Singling	Dates of application of top-dressing of Nitrate of Soda.			Top-dressed with 3 Cwt. Nitrate of Soda per Statute Acre, applied in Three Separate Dressings.							
						Yield per Statute Acre (Factory Weight).				Sugar Content of Roots.			
			1st Application	2nd Application	3rd Application	Wohanka Variety	Horning Variety	German Variety	Dutch Variety	Wohanka Variety	Horning Variety	German Variety	Dutch Variety
						T. C.	T. C.	T. C.	T. C.	%	%	%	%
Athenry ·	21-5-27	12-7-27	29-7-27	9-8-27	20-8-27	8 7	8 0	9 8	6 11	17·1	17·0	17·5	16·0
Ballyhaise ·	19-5-27	8-7-27	12-7 27	19-7-27	26-7-27	7 2	7 11	8 4	6 17	16·9	15·6	16·0	16·3
Clonakilty ·	5-5-27	14-6-27	24-6-27	8-7-27	22-7-27	14 8	14 1	13 13	15 10	16·1	17·0	16·2	16·9
Glasvenin ·	13-5-27	23-6-27	24-6-27	—	—	7 18	9 0	9 11	8 15	14·7	16·4	15·9	15·2
Average (Four Centres) ...						9 9	9 13	10 3	9 8	16·2	16·5	16·4	16·1

The average returns produced by the Wohanka variety are slightly inferior to those produced by the other three varieties, and in view of the fact that this variety also produced the greatest number of "bolters," it does not appear to be as suitable for cultivation in this country as the other varieties included in the trials. The Horning variety, whilst slightly superior in yielding capacity, was inferior as regards sugar content to both the Dutch and the German varieties, and as it produced a relatively large number of bolters, it cannot be considered so suitable for cultivation in this country as either the Dutch or the German variety.

On the average, slightly better yields were obtained from the plots to which farmyard manure was applied in the winter than from the corresponding plots to which the manure was applied in the spring. This was most marked at the Athenry and Glasnevin centres. The time of application of the farmyard manure does not, however, appear to have exercised any appreciable influence on the sugar content of the beet, or on the shape of the roots.

The top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre slightly increased the yield, but the heavier top-dressings did not, on the average produce any additional increased yield. On the whole, the top-dressings of nitrate of soda in excess of 1 cwt. per statute acre, reduced the sugar content of the beet but, except at the Ballyhaise centre, the reduction is almost negligible.

Different Dressings of Artificial Manures applied at different seasons.

With the object of comparing the effects of dressings of basic slag and kainit applied in winter and immediately before sowing with the standard dressing of artificial manures and a dressing consisting of 4 cwt. superphosphate, 4 cwt. kainit and 2 cwt. sulphate of ammonia per statute acre applied at the usual time, *i.e.*, in the drills at the time of sowing, a series of plots were laid down at each centre on the same lines as last season, and as shown on the plan facing page 44. Apart from the differences in the composition and application of the dressings of artificial manures, the crop on all the plots was treated in exactly the same manner as the sub-plots in the variety and top-dressing trials which received a top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre.

During the growing season, no outstanding difference was noticeable in the general appearance of plants on the different plots at any of the centres. The results from the portions of the plots to which farmyard manure was applied in winter and in spring are shown separately in Tables X and XI respectively.

TABLE X.

Returns from Plots to which Farmyard Manure was applied in Winter.

	Artificial Manures applied per Statute Acre.	Yield per Statute Acre (Factory Weight).				Sugar Content of Roots.				Average.	
		Athenry	Ballyhaise	Clonakilty	Glasnevin	Athenry	Ballyhaise	Clonakilty	Glasnevin	Yield (Factory Weight)	Sug Con
		T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
1.	The equivalent of 4 cwt. 35% Superphosphate in the form of High Grade Basic Slag applied in Winter. 4 cwt. Kainit, applied in the drills before sowing. 1 cwt. Sulphate of Ammonia, applied in the drills before sowing.	8 0	6 16	15 8	11 14	17·3	16·1	17·1	13·6	10 7	16
2.	4 cwt. 35% Superphosphate, applied in the drills before sowing. 4 cwt. Kainit, applied in Winter. 1 cwt. Sulphate of Ammonia, applied in the drills before sowing.	9 10	7 1	15 6	11 10	17·5	17·3	16·3	14·4	10 17	1
3.	High Grade Basic Slag at the same rate as in Plot (1), but applied in the drills before sowing. 4 cwt. Kainit, applied in the drills before sowing. 1 cwt. Sulphate of Ammonia, applied in the drills before sowing.	8 10	7 8	15 13	9 3	17·0	17·4	16·7	16·1	10 3	1
4.	4 cwt. Superphosphate (35%), applied in the drills before sowing. 4 cwt. Kainit, applied in the drills before sowing. 1 cwt. Sulphate of Ammonia, applied in the drills before sowing.	8 18	7 3	18 1	9 10	16·5	16·9	16·6	16·0	10 18	
5.	4 cwt. Superphosphate (35%), applied in the drills before sowing. 4 cwt. Kainit, applied in the drills before sowing. 2 cwt. Sulphate of Ammonia, applied in the drills before sowing.	8 0	7 10	17 13	10 11	16·6	17·7	16·4	15·2	11 1	

TABLE XI.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN SPRING.

Artificial Manures applied per Statute Acre.	Yield per Statute Acre. (Factory Weight)				Sugar Content of Roots.				AVERAGE.	
	Athenry	Ballyhaise	Clonakilty	Glasnevin	Athenry	Ballyhaise	Clonakilty	Glasnevin	Yield (Factory Weight).	Sugar Content
	T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
The equivalent of 4 cwts. 35% Superphosphate in the form of High Grade Basic Slag, applied in Winter. 4 cwt. Kainit, applied in the drills before sowing. 1 cwt. Sulphate of Ammonia, applied in the drills before sowing.	7 10	7 4	14 19	9 18	17·0	18·0	16·7	16·3	9 18	17·0
4 cwt. Superphosphate (35%), applied in the drills before sowing. 4 cwt. Kainit, applied in Winter 1 cwt. Sulphate of Ammonia, applied in the drills before sowing.	7 17	6 12	7 3	9 12	17·1	16·0	17·4	16·0	10 6	16·6
High Grade Basic Slag at the same rate as in Plot (1), but applied in the drills before sowing. cwts. Kainit, applied in the drills before sowing. cwt. Sulphate of Ammonia, applied in the drills before sowing.	8 7	7 10	16 16	9 5	17·0	17·4	16·6	15·9	10 7	16·7
cwt. Superphosphate (35%), applied in the drills before sowing. cwt. Kainit, applied in the drills before sowing. cwt. Sulphate of Ammonia, applied in the drills before sowing.	7 16	7 8	16 11	8 18	17·7	16·4	15·7	14·4	10 3	16·0
cwt. Superphosphate (35%), applied in the drills before sowing. cwt. Kainit, applied in the drills before sowing. cwt. Sulphate of Ammonia, applied in the drills before sowing.	8 3	8 6	15 9	7 4	16·4	16·3	16·7	14·3	9 15	15·9

As there is remarkably little difference in the average returns from the various sub-plots, it may be inferred that good results may in general be expected where the standard dressing consisting of 4 cwt. superphosphate, 4 cwt. kainit. and 1 cwt. sulphate of ammonia per statute acre is applied, and that no advantage is to be gained by applying portion of this dressing in winter, or by substituting basic slag for superphosphate in the mixture. As in the case of the variety experiments, slightly better yields were obtained from the portions of the plots where the farmyard manure was applied in winter.

Width of Drills.

As in the previous season, a series of plots in which the drills were of varying width, were laid down at each centre. The general arrangement of the plots was as shown on the plan. In all respects, except in the width of the drills, the crop on the plots was treated in exactly the same

manner as that on the sub-plots in the variety and top-dressing trials which was top-dressed with nitrate of soda at the rate of 1 cwt. per statute acre. From one centre it was reported that some difficulty was experienced in avoiding injury to the plants when cultivating, with the ordinary implements, between the drills which were 18 inches apart. In the case of the drills 21 inches in width no such difficulty arose at any centre.

Weighings and analyses were obtained from both portions of each plot to which farmyard manure was applied either in winter or in spring, and the results are shown separately in Tables XII and III, respectively.

TABLE XII.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN WINTER.

CENTRE.	Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.
	T. C.	T. C.	T. C.	%	%	%
Athenry ...	8 16	8 3	7 13	18·1	17·9	17·4
Ballyhaise ...	6 0	8 3	7 10	16·6	17·1	14·9
Clonakilty ...	16 6	17 16	15 13	16·5	16·5	15·3
Glasnevin ...	12 8	9 8	9 7	15·6	15·9	15·8
Average (Four Centres) ...	10 18	10 18	10 1	16·7	16·8	15·9

TABLE XIII.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN SPRING.

CENTRE.	Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.
	T. C.	T. C.	T. C.	%	%	%
Athenry ...	8 10	7 3	7 0	18·2	17·6	16·6
Ballyhaise ...	7 8	7 12	6 18	16·0	16·7	16·0
Clonakilty ...	16 17	16 18	17 6	16·5	16·6	16·9
Glasnevin ...	9 7	8 0	8 0	15·7	15·2	13·7
Average (Four Centres) ...	10 1	9 18	9 16	16·6	16·8	15·8

On the average there is practically no difference in the returns both as regards yield and sugar content of the crops from the sub-plots where the drills were 18 inches and 21 inches wide respectively. The results from both these series of sub-plots were, however, definitely superior to those obtained from the sub-plots where the drills were 24 inches wide.

The yields and sugar content were on the average higher on the portions of the plots to which the farmyard manure was applied in winter than on the corresponding portions where the manure was applied in spring.

Singling of the Plants to different distances apart.

Plots on which the plants were singled to 8 inches and 12 inches apart, respectively, were again arranged at each centre. The general arrangement of the sub-plots is shown in the plan facing page 44. Apart from the singling of the plants to different distances apart, the crop on these plots was treated in exactly the same manner as crop on the plots in the "width of drills" test, conducted at the same centres. As in the other tests, the results from both portions of each plot to which farmyard manure was applied either in winter or in spring are shown separately in Tables XIV and XV, respectively.

TABLE XIV.

Returns from Plots to which Farmyard Manure was applied in Winter.

Centre.	Distance apart of Singling.	Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
		18-inch Drills.	21-inch Drills.	24-inch Drills.	18-inch Drills.	21-inch Drills.	24-inch Drills.
		T. C.	T. C.	T. C.	%	%	%
Athenry ...	8 inches ...	8 17	9 4	9 18	17·3	17·0	17·5
Ballyhaise ...	8 inches ...	7 10	7 12	6 10	16·9	17·0	17·0
Clonakilty ...	8 inches ...	14 13	14 11	15 19	16·3	15·6	17·0
Glasnevin ...	8 inches ...	8 15	13 4	9 5	15·5	16·9	13·9
Average (Four Centres) ...		9 19	11 3	10 8	16·5	16·6	16·3
Athenry ...	12 inches ...	9 1	8 8	8 6	17·8	17·0	17·1
Ballyhaise ...	12 inches ...	8 6	7 14	6 4	16·7	16·1	17·6
Clonakilty ...	12 inches ...	17 4	16 3	15 9	16·4	15·7	16·7
Glasnevin ...	12 inches ...	9 15	11 11	8 14	12·5	14·4	14·7
Average (Four Centres) ...		11 1	10 19	9 13	15·8	15·8	16·4

TABLE XV.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN SPRING.

CENTRE.	Distance apart of Singling.	Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
		18-inch Drills.	21-inch Drills.	24-inch Drills.	18-inch Drills.	21-inch Drills.	24-inch Drills.
		T. C.	T. C.	T. C.	%	%	%
Athenry ...	8 inches ...	8 4	6 14	8 10	18·0	16·7	17·5
Ballyhaise ...	8 inches ...	7 5	6 3	8 0	16·1	16·7	15·5
Clonakilty ...	8 inches ...	14 14	15 4	16 13	17·5	17·1	16·7
Glasnevin ...	8 inches ...	7 16	10 10	8 13	14·0	16·0	15·0
Average (Four Centres) ...		9 9	9 13	10 9	16·4	16·6	16·2
Athenry ...	12 inches ...	8 16	6 13	6 13	17·9	17·3	17·0
Ballyhaise ...	12 inches ...	7 15	6 18	6 0	16·0	17·0	16·1
Clonakilty ...	12 inches ...	17 10	15 7	15 3	16·0	16·2	16·5
Glasnevin ...	12 inches ...	5 5	10 10	8 1	13·8	13·9	15·2
Average (Four Centres) ...		9 16	9 17	8 19	15·9	16·1	16·2

On the plots where the drills were 18 inches apart, better yields were obtained, where the plants were singled to 12 inches apart than when singled to 8 inches apart, while in the case of the drills 24 inches wide, the reverse was the case.

On the plots where the drills were 21 inches in width, the difference in the distance between the plants in the drills did not influence the yield. As regards the sugar content of the samples drawn from the different plots, slightly better results on the average were obtained from the crop grown in drills measuring 18 inches and 21 inches in width, when the plants were singled to 8 inches apart as compared with 12 inches apart but the average sugar content of the beet from the drills 24 inches wide was apparently not influenced by the distance between the plants in the rows.

As in the other trials conducted at these centres, slightly better yields were obtained where the farmyard manure was applied in winter.

Singling at different stages of growth.

As shown on the plan facing page 44, this experiment comprised three plots of six drills each, at each centre. The crop on the middle plot at each centre was singled to 9 inches apart at the same time as the general crop of sugar beet grown on the same field was being singled, *i.e.*, when the plants had reached the four-leaf stage. The crop on one of the other plots was singled to the same distance apart about 10 days earlier, and on the third plot the

plants were singled in the same manner about 10 days later than the crop on the middle plot. Apart from the differences in the dates of singling, these plots received exactly the same treatment as the sub-plots in the variety and top-dressing trials at the same centres which received a top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre. Weighings and analyses were obtained from both portions of each plot to which farmyard manure was applied either in winter or in spring, and the results are shown separately in Tables XVI and XVII, respectively.

TABLE XVI.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN WINTER.

CENTRE.	Date of Sowing.	Date of Singling.			Yield per Statute Acre (Factory Weight)			Sugar Content of Roots.		
		"Early"	"Normal"	"Late"	"Early"	"Normal"	"Late"	"Early"	"Normal"	"Late"
					T. C.	T. C.	T. C.	%	%	%
Athenry	21/5/27	5/7/27	13/7/27	23/7/27	8 11	8 1	7 8	17·0	16·7	17·1
Ballyhaise	19/5/27	27/6/27	9/7/27	19/7/27	6 4	7 10	6 14	16·7	17·0	16·6
Clonakilty	5/5/27	8/6/27	20/6/27	30/6/27	16 16	16 6	16 9	16·5	15·4	16·5
Glasnevin	13/5/27	3/6/27	24/6/27	5/7/27	9 18	11 10	9 13	14·4	15·9	15·9
Average (Four Centres)					10 7	10 17	10 1	16·2	16·2	16·5

TABLE XVII.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN SPRING.

CENTRE.	Date of Sowing.	Date of Singling.			Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
		"Early"	"Normal"	"Late"	"Early"	"Normal"	"Late"	"Early"	"Normal"	"Late"
					T. C.	T. C.	T. C.	%	%	%
Athenry	21/5/27	5/7/27	13/7/27	23/7/27	6 14	8 3	7 4	17·1	17·5	17·2
Ballyhaise	19/5/27	27/6/27	9/7/27	19/7/27	5 14	6 11	7 5	15·3	14·8	15·8
Clonakilty	5/5/27	8/6/27	20/6/27	30/6/27	15 7	15 19	15 10	16·1	16·9	16·5
Glasnevin	13/5/27	13/6/27	24/6/27	5/7/27	9 1	9 10	10 0	15·5	16·4	17·2
Average (Four Centres)					9 4	10 1	10 0	16·0	16·4	16·7

On the average there is but little difference in the returns from the different plots. Slightly better yields were, however, obtained where the plants were

singled at the "normal" date, *i.e.*, when they had reached the four-leaf stage of growth than where singling was carried out at an "early" or at a "late" date. The date of singling does not appear to have appreciably influenced the sugar content of the roots. In this experiment also slightly better yields were obtained from the proportions of the plots to which the farmyard manure was applied in winter.

Methods of Cultivation.

The arrangement of this experiment was exactly similar to that adopted last season, and was as follows:—

Two plots of six drills each were laid down at each centre. The two plots were treated similarly at each centre, except in regard to after-cultivation of the crops. In each case one of the plots was cultivated in a manner which may be regarded as better than that which would generally be accorded to the sugar beet crop grown under ordinary conditions. During the same period the other plot received less attention as regards after-cultivation than would be given under ordinary conditions. Particulars regarding the after-cultivation of the plots at each centre, and the results obtained from weighings and analyses in respect of the portions of the plots to which farmyard manure was applied either in winter or in spring are shown separately in Tables XVIII and XIX, respectively.

TABLE XVIII.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN WINTER.

Centre.	Treatment of "Better Cultivated Plot."	Treatment of "Badly Cultivated Plot."	Yield per Statute Acre.		Sugar Content of Roots.	
			"Better Cultivated Plot."	"Badly Cultivated Plot."	"Better Cultivated Plot."	"Badly Cultivated Plot."
			T. C.	T. C.	%	%
Athenry . .	Hand-hoed twice . Horse-hoed six times .	Hand-hoed once Horse-hoed twice	9 16	7 16	17·4	17·5
Ballyhaise . .	Horse-hoed six times . Hand-hoed twice Hand-weeded once	Horse-hoed twice Hand-hoed once	6 17	6 10	16·7	17·1
Clonakilty . .	Hand-hoed once . Horse-hoed five times Hand-weeded once	Hand-hoed once Horse-hoed three times Hand-weeded once	17 17	16 17	16·8	16·9
Glasnevin . .	Hand-hoed twice . Horse-hoed four times before Singling	No cultivation before Singling	11 3	11 0	13·0	14·7
Average (Four Centres)			11 8	10 11	16·0	16·5

TABLE XIX.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN SPRING.

CENTRE.	Treatment of "Better Cultivated Plot."	Treatment of "Badly Cultivated Plot."	Yield per Statute Acre.		Sugar Content of Roots.	
			"Better Cultivated Plot."	"Badly Cultivated Plot."	"Better Cultivated Plot."	"Badly Cultivated Plot."
			T. C.	T. C.	%	%
Athenry	Hand-hoed twice, Horse-hoed six times	Hand-hoed once, Horse-hoed twice	9 10	8 0	17·5	17·8
Ballyhaise	Horse-hoed six times, Hand-hoed twice, Hand-weeded twice	Horse-hoed twice, Hand-hoed once	6 8	6 12	15·6	15·6
Clonakilty	Hand-hoed once, Horse-hoed five times, Hand-weeded once	Hand-hoed once, Horse-hoed three times, Hand-weeded once	17 7	13 13	16·7	17·2
Glasnevin	Horse-hoed four times, Hand-hoed twice before Singling	No cultivation prior to Singling	9 18	10 4	15·3	15·5
Average (Four Centres) ...			10 16	9 12	16·3	16·4

From all sub-plots, with a single exception, better yields were obtained from the plots which received extra attention as regards cultivation after the crop was sown. Whilst there was little difference in the average sugar content of the samples from the different plots at each centre, it is rather remarkable that, with one exception, a higher sugar content was obtained from the "badly cultivated" crop than from the "better cultivated" one. On the average, however, the increased yield due to extra cultivation would more than compensate for the lower sugar content of the beet grown on the "better cultivated" plots. Here again better results were obtained from the portions of the plots to which the farmyard manure was applied in winter.

Experiments at the Munster Institute Farm.

As it has been suggested that phosphates exercise a considerable influence on the maturity or ripening of the sugar beet crop, and that the ripening of the crop can be hastened by the application of extra dressings of phosphatic manures, it was decided to conduct a trial at The Munster Institute Farm to determine the effects of different quantities of superphosphate on the yield and sugar content of the sugar-beet crop. The experiment was arranged as follows :—To three adjacent plots of similar size a uniform dressing of farmyard manure was applied. In addition, Plot I received a dressing of artificial manures consisting of a mixture of 6 cwt. superphosphate (35%), 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre. The second plot was dressed with a similar dressing plus an additional 2 cwt. of superphosphate (35%) per statute acre. The third plot was dressed in the same manner as Plot I but in addition, an extra 4 cwt. superphosphate (35%) per statute acre was applied. The Dutch (Kuhn P.), variety of seed was dibbled in at the same rate per acre on all plots.

The seedling beet on these three plots was so severely attacked by mangel fly that the leaves of the plants became somewhat stunted and brown in colour. Although it was difficult, in these circumstances, to make reliable observations it appeared at the time of thinning that the plants on Plots II and III, which received the extra amounts of superphosphate, were slightly more vigorous than those on the remaining plot. No difference was, however, noted in the appearance of the crop on the three plots during the later stages of growth.

Particulars of the yield and sugar content of the beet on the different sub-plots are shown in Table XX.

TABLE XX.

No. of Plot	Manuring per Statute Acre. Super-phos-phate 35%	Kainit.	Sulphate of Ammonia.	Date of Sow-ing.	Date of Sing-ling.	Date of Lifting and Weighing.	Yield per Statute Acre (Factory Weight).	Sugar Content of Roots.
	cwt.	cwt.	cwt.				T. C.	%
I	6	4	1	29 Apl.	11 June	16 Nov.	10 18	15·9
II	8	4	1	do.	do.	do.	10 14	15·5
III	10	4	1	do.	do.	do.	11 7	16·7

As the returns from these plots may have been influenced by the severe attacks of mangel fly, no definite conclusions should be drawn from the results of this experiment as to the effects of the extra dressings of superphosphate on the yield and sugar content of the crop. It is evident, however, from this trial that even a relatively heavy dressing of superphosphate is not likely to exercise any appreciable influence on the ripening of the crop as indicated by its general appearance.

SUMMARY OF THE RESULTS OF THE PRINCIPAL EXPERIMENTS WITH SUGAR BEET CONDUCTED IN THE YEAR 1927.

(1) Of the five varieties tested on a large scale, the Dutch and German varieties were equal as regards yield and sugar content, and in these respects they were superior to the Danish and French varieties. The Wohanka variety was distinctly inferior as regards yield to any of the other varieties, but in sugar content it was slightly better than even the Dutch and German varieties.

(2) The average returns from the large-scale variety trials conducted under the supervision of the County Instructors in Agriculture at 127 centres were :—

	Yield (Factory Weight) tons.	cwt.	Sugar Content. %
Dutch	11	2	17·6
German	11	2	17·6
Danish	10	18	17·0
French	10	16	17·0
Wohanka	10	4	17·7

(3) Slightly better yields were obtained where farmyard manure was ploughed in during winter. The application of well-rotted farmyard manure in the drill before sowing did not, however, appear to affect, adversely, the shape of the roots.

(4) A top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre applied after the crop was singled, increased the average yield by 9 cwt. per statute acre, but decreased the average sugar content of the beet by 0·14%. The increase in the average yield was due very largely to the rather marked effect of the top-dressing on the crop at a number of centres where the beet was sown under unfavourable conditions or where mangel fly attacked the crop to a serious extent.

(5) The best results as regards both yield and sugar content were obtained where the drills were 21 inches or less in width.

(6) Better results were obtained where the plants were singled at the stage when they had developed four rough leaves than when the singling was performed at either an earlier or a later stage of growth.

SUMMARY OF THE RESULTS OF THE PRINCIPAL EXPERIMENTS WITH SUGAR BEET CARRIED OUT IN EACH OF THE YEARS 1925, 1926 and 1927.

(1) Of the four varieties of sugar beet included in the trials conducted during the three seasons, the Dutch (Kuhn & Co. P.) and the German (Klein Wanzleben Original Z) varieties were superior both as regards yield and sugar content to the Danish (Scandinavian Seed Co's K 7866), and the French (Vilmorin's Improved Selection B) varieties. While the yield and sugar content of the Dutch and German varieties were practically identical, the Dutch variety was distinctly superior to the German variety as regards the tendency to bolt, and it is, therefore, more suitable than the latter variety for cultivation in this country.

(2) A top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre applied after the crop was singled, did not lower appreciably the sugar content of the beet. The increased yield resulting from this top-dressing depended largely on the condition of the soil and the growth of the crop at the time it was applied. Under favourable conditions of soil and growth, the top-dressing did not materially increase the yield, but in unfavourable seasons, or under adverse conditions, as for example, where the crop was attacked by pests or diseases, the top-dressing of nitrate of soda was the means of carrying the plants over a critical period in the early stages of growth. The top-dressings of nitrate of soda in excess of one cwt. per statute acre slightly depressed the sugar content of the beet without producing any compensating increase in yield.

COMPARATIVE AGRONOMIC VALUES OF RED AND WHITE CLOVERS OF DIFFERENT ORIGIN.*

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Considering the great importance of red and white clovers, both as forage crops and as soil improvers, it is remarkable that until quite recently so little attention has been devoted to these two crops. Although the main difference between English broad red clover and English single-cut clover had been noticed by a few observant agriculturists over a century ago, it is only within the last 15 to 20 years that it has been generally realized that red and white clovers comprise a large number of varieties which differ widely in their cropping capacities, their ability to hold the ground, their resistance to diseases and other characteristics that have a profound effect on yield.

RED CLOVER.

In recent years a considerable amount of valuable information concerning the relative value of certain varieties of red clover has been obtained as a result of various trials conducted by Finlay at Aberdeen, Smith at Leeds, and Johnstone-Wallace and Colin Ross in Devon, and by other workers. During the last eight or nine years an extensive series of trials with red clover has been carried out by the Welsh Plant Breeding Station. In these trials hundreds of samples from practically all known sources have been tested under hay and pasture conditions, both at Aberystwyth and in different centres in various counties in Wales. The facts considered below are mainly based on the results of these trials.

There are approximately about 30 different varieties and nationalities of red clover on the market. All these may be classified, according to their time of flowering and other characteristics, into three major groups, namely, (1) early flowering clovers; (2) late flowering clovers, and (3) wild red clovers. The early red clovers that are most commonly sown in Britain are English broad red, Vale of Clwyd (early form), Canadian, New Zealand, American medium, Chilian, Brittany, French, Italian, Czecho-Slovakian, Silesian and Polish. Small quantities of early red clover seed are also imported from Holland, Denmark, Germany and Switzerland. There are four varieties of late flowering red clover endemic to Britain; these are Montgomery, Cornish marl, English late and Vale of Clwyd (late form). Of the foreign late the most well-known are American Mammoth (U.S.A.), Altaswede (Canada), Swedish, Danish, Norwegian, Polish and Russian. In view of the great difference in hardiness between the early and late flowering red clovers it is a very significant fact that nearly all the early varieties are confined to the warm temperate regions of Europe and America, while practically all the late clovers are grown only in the cold temperate regions.

* A paper read at a conference of Agricultural Instructors at Dublin on 21st June, 1928.

The three groups—early, late and wild—into which red clover may be divided are quite distinct and can be fairly easily distinguished. As the terms early and late indicate, one of the most outstanding differences between the early and late clovers is their time of flowering, or, in other words, in their relative rate of growth. The early flowering varieties bloom from about two to five weeks earlier than the late clovers. The two groups differ in many other botanical characteristics. The late flowering clovers have denser and more tufted growth than the early clovers, which are usually laxer and decidedly more erect. The late clovers can also be differentiated from the early varieties, particularly during the earlier stages of growth, by their smaller, relatively broader and darker green leaves. The former also tiller much more freely while the stems are generally longer and more branched than those of the latter.

As already mentioned, the early and late clovers differ very considerably in their relative rates of growth. The early varieties are capable of making much more growth than most of the late clovers in the seeding year and as a result of that they generally produce much more stubble grazing. Moreover, the early clovers contribute far more towards spring grazing, since they start active growth some two to five weeks earlier than the late varieties. On the other hand, Montgomery, which is very tardy in starting active growth in the spring, seldom produces much growth before the first week in May.

Another important difference is that the early clovers generally produce two crops of hay annually, while the late varieties only yield one full crop—the aftermath growth being usually comparatively small unless the hay has been cut early.

From an agronomic point of view the main difference between the early and late clovers is in their relative persistency. On most soils and in most seasons the early clovers behave in the main as biennials, as they generally die off almost completely during the second winter. The late varieties, on the other hand, behave in the main as short-lived perennials: they are all capable of yielding good crops in the first and second harvest years, while a few varieties usually last fairly well on land adapted to clover into the third and fourth year. It is, therefore, quite evident that the early varieties are only suitable for one year leys. Even for this purpose they are inferior to the late clovers on certain types of soil. It is generally acknowledged that on really first-class land certain early varieties are usually more productive in the first year than the lates, but there appears to be no doubt that on second-class land, on soils deficient in lime, and in exposed districts, the late varieties almost invariably yield much heavier crops than the best early varieties even in the first year. The numerous trials that have been carried out at Aberystwyth and other centres in Wales have proved conclusively the superiority of most of the late varieties under these conditions. The results of a few of these trials have been summarized in Tables I. and II. In the second harvest year there is no comparison between the late and early clovers, as most of the latter die off almost completely during the preceding winter. Not only has it been

found that the late clovers are more productive and last longer than the early clovers, but it has also been shown that they are more resistant to the clover eelworm and *Sclerotinia* infections, and therefore they should always be sown on clover-sick land in preference to the early sorts.

TABLE I.—RELATIVE YIELDS OF HAY AND AFTERMATH OF A FEW VARIETIES AND NATIONALITIES OF RED CLOVER IN THE FIRST HARVEST YEAR AT ABERYSTWYTH.

	1921	1923	1924	1925	1926	1927
Late Clovers.						
Montgomery	100	100	100	100	100	100
English	104	107	63	110	120	—
Swedish	96	88	123	—	65	104
American Mammoth ...	64	85	84	—	104	76
Early Clovers.						
English Broad Red ...	111	62	47	70	58	58
American Medium ...	79	65	69	—	—	66
Chilian	86	48	—	—	—	—
Italian	39	20	—	—	—	—
Wild.						
Indigenous	—	84	58	—	75	—

TABLE II.—THE RELATIVE YIELDS OF HAY AND AFTERMATH OF A FEW VARIETIES OF RED CLOVER IN THE SECOND AND THIRD HARVEST YEARS AT ABERYSTWYTH.

	Second Harvest Year.				Third Harvest Year.	
	1921	1924	1925	1927	1924	1925
Late Clovers.						
Montgomery	100	100	100	100	100	100
English	100	52	60	78	61	34
Swedish	71	79	57	—	26	4
American Mammoth ...	—	86	—	50	32	10
Early Clovers.						
English Broad Red ...	56	5	27	12	0	6
American Medium ...	71	19	43	—	8	6
Chilian	34	2	—	7	0	0
Italian	0	0	—	—	0	0
Wild.						
Indigenous	—	91	56	92	74	107

Wild Red Clover.

Since only small quantities of wild red clover seed are harvested annually, this variety is not yet of great economic importance. Wild red clover can be fairly easily distinguished from the cultivated red clovers, as the plants are usually much smaller and more prostrate; the leaves are also distinctly smaller, the stems shorter, more slender, wiry, fibrous and solid than those of the early and late varieties. Wild red clover consists of numerous forms which differ widely in regard to productivity, leafiness, persistency

and other characteristics. Some of the most stemmy forms bloom very early during April and May, while the more leafy and better forms do not flower until the end of June or early in July. As regards its yielding capacity, wild red is not so productive as the later varieties during the first year. In the second year it has been found to yield quite as heavily as many of the foreign late clovers, but except on very exposed hilly districts, where it has been found to give excellent results, it is generally inferior to Montgomery and Cornish marl in the second year. On most soils it does not seem to hold the ground any better than the most lasting of the late varieties.

Late Varieties.

Montgomery and Cornish Marl.

These two clovers are so similar that they should almost be regarded as one variety. Their outstanding agronomic characteristic is their persistency. With the exception of the wild red they have proved to be easily the most lasting of all the different varieties and nationalities tested at Aberystwyth (See Table II.). They can always be relied upon to yield heavy crops in the first and second years, and on certain types of soils they generally yield quite good crops in their third years. As already pointed out, one of their chief faults is that they are very late in starting growth in the spring, with the result that they contribute but very little towards grazing in spring when keep is usually very scarce. As these two clovers do not flower until about the fourth week in July, the crops should be cut before they are fully matured. In fact it is always advisable to have all crops consisting largely of late flowering clover mown during the early bud stage, because if the cutting is delayed much beyond this stage the crops are apt to become badly laid. The reduction in the yield of hay as a result of early cutting is always compensated for by a corresponding increase in the aftermath crop.

Unfortunately the yields of seed of Montgomery and Cornish marl fluctuate widely according to the season. For instance, in 1925, which was a very favourable year from the point of view of red clover seed production, about 60-70 tons of certified Montgomery seed were harvested, while in 1927, which was a very unfavourable year, only about 5 tons were saved. It is estimated that this year about 60 tons of Montgomery and about 40 tons of Cornish marl seed have been harvested.

English Late.

On most soils English late generally produces slightly heavier crops than Montgomery and Cornish marl in the first harvest year, but as it is not so persistent it is appreciably less productive than the latter in the second harvest year, and is decidedly not so lasting in the third year. Apart from the fact that it is slightly more productive in the seeding and first harvest years, English late has one distinct advantage over Montgomery and Cornish marl in that it starts growth earlier in the spring and generally produces more aftermath growth.

By virtue of the heavy crops it gives in the first year, English late is pre-eminently suitable for sowing in one-year leys, except possibly on the better-class soils where English broad red may give better results. For leys of more than one year's duration English late is not so suitable as Montgomery and Cornish marl.

English late is grown for seed chiefly in East Anglia and the Cotswolds. A heavy seed yield is expected in 1928.

Vale of Clwyd Late.

Only a small quantity of seed of this variety is harvested annually. In type it is almost intermediate between English late and Montgomery. It is decidedly less persistent than the latter.

Swedish Late.

Swedish late is undoubtedly one of the best of the foreign late varieties. It is strongly recommended that this clover be sown in all leys of more than one year's duration when the supplies of the home-grown lates are scarce. In view of the excellent cropping qualities of Swedish late it is unfortunate that only comparatively small quantities of seed of this clover are imported annually into Britain. Swedish late generally yields very heavy crops of hay and of fairly good aftermath in the first year. (It also starts growth fairly early and therefore contributes more grazing during April and May than Montgomery and Cornish marl). It may generally be depended upon to yield well in the second harvest year, but in all the Aberystwyth trials it did not last into the third year.

Danish Late.

This is another very good variety which behaves very similarly to Swedish late as regards its cropping qualities and persistency. Only a very small amount of seed of the clover is imported into Britain.

Norwegian Late.

The amount of seed of Norwegian late imported is almost negligible. This variety has a much shorter growing season than any other variety so far tested at Aberystwyth. It starts growth very late in the spring and comes to a standstill early in the autumn, with the result that it is usually appreciably less productive than all other late varieties in the first year. However, in the second year it compares quite favourably with most of the foreign late varieties and it lasts into the third year rather better than Swedish and Danish lates.

Russian Late.

This clover is not unlike the Swedish late in many respects, except that it starts growth rather earlier in the spring and matures a week or so earlier. It has proved very productive in the first year and moderately productive in the second year, but the few samples that have been tested so far have failed to last into the third year. It appears that only comparatively small quantities of seed of Russian late are imported.

American Mammoth.

This variety holds very much the same position in North America as English late does in Britain. On suitable soils it is capable of producing very heavy crops in the first harvest year. On the poorer classes of soil it is certainly not so productive as the native lates or even some of the late varieties from North Europe. It seldom lasts well into the second year and never into the third year. This variety is rather late starting growth in the spring, and as it ceases active growth early in the autumn its aftermath crop is usually rather poor. American Mammoth is exceedingly hairy, both stems and leaves are densely covered with comparatively long spreading hairs, for this reason it is less palatable to stock, particularly to sheep, than any other red clover variety yet tested with the exception of American medium which is equally hairy.

In some seasons very considerable quantities of seed of this clover are imported into Britain. However, it should only be sown when the seeds of the native and North Europe late clovers cannot be obtained. Nevertheless it should be sown in preference to the early clovers in leys intended to be laid for more than one year. On poorer soil it will generally give better results than the early clover even in one-year leys.

Altaswede.

This is a new variety that has been recently bred at Alberta University from Swedish late. It seems to be rapidly gaining ground in Canada. Under our conditions it does not appear to be in any way superior to the ordinary Swedish late; as far as the writer is aware no seed of this variety has been imported for general use into Britain.

Early Red Clover Varieties.

It is very important that a farmer buying seeds of early flowering red clover should bear in mind that the early clovers from North Europe, Britain, Holland, Brittany, Denmark, Germany, Silesia; North America and New Zealand are much more hardy and are better adapted in every way to our conditions than seeds from the warm temperate regions of Europe and America. It has been proved conclusively that Italian red clover is totally unsuitable for our conditions. It very often fails almost completely during the first winter. Even after a comparatively mild winter the crop is usually very light. Although during the last few years far less Italian seed has been imported into Britain than was formerly the case, there is still quite a considerable amount of this almost worthless seed sown every year. It is estimated that approximately 40 tons of seed of this clover were shipped to Britain last year. Farmers would also be well advised to give all red clover seed emanating from the South of France a very wide berth, as this clover is scarcely any better than the Italian. The red clovers from Brittany or the North of France, though they are not so reliable as the home-grown early clovers, are distinctly superior under our conditions to those grown farther South. It is estimated

that last year about 1,000 tons of red clover seed were imported from France, and it is not improbable that a very considerable proportion of this consignment came from the South. Chilian is another non-hardy clover. Although it generally gives far better crops than the seeds from Italy and the South of France, it is apt to become badly winter-killed on exposed fields. If used at all it should only be sown in well-sheltered fields.

The most reliable and the most hardy of the early red clovers are (1) medium red from the Northern States of America; (2) Canadian: (3) Vale of Clwyd (early form); (4) New Zealand: (5) English broad red. The Vale of Clwyd and English broad red give heavier crops than American medium and Canadian, but they are not so hardy.

Of the early clovers obtained from the Continent those grown in Switzerland and Silesia are among the best. The so-called Mountain red advertised in various seedsmen's catalogues as a hardy clover grown on the Alps is no more hardy at Aberystwyth than ordinary Swiss red.

Quite considerable quantities of red clover seed are imported into Britain from Poland and Germany, Czecho-Slovakia and South Russia. They are distinctly more hardy and more productive than the seeds from South Europe.

Farmers are often misled when selecting red clover seed for sowing by the general appearance of the seeds. The seeds from the warm temperate countries, as for example, Italy, the South of France and Chile—the very seeds he should avoid at all costs—invariably have a much brighter colour and are generally much better in quality as regards germination and purity than the home-grown seeds. Provided the prices are about the same, more often than not the buyer selects the best-looking seeds without any regard to the source of origin. It is not yet sufficiently realized that the variety or strain of clover seed is of primary importance. While a very poor looking sample of English late or Montgomery clover seed consisting largely of brown seeds and germinating only 50 per cent. should not be sown, such seed would give far better results than a bright looking sample of Italian red with a germination of 100 per cent., owing to the fact that the latter variety is unsuitable to the conditions prevailing in Great Britain and Ireland.

White Clover.

There are several distinct varieties of wild white clover on the market. The four that are most commonly grown in Britain are Wild, Dutch, New Zealand and Ladino.

In comparison with Dutch white, Wild white clover has a relatively slower, denser and more matted growth; the leaves are smaller and the pedicels are shorter, while the runners, which have much shorter internodes, take root much more readily at the nodes; and it is this that largely accounts for its greater aggressiveness and its ability to hold the ground for a large number of years. As regards their relative productivity Wild white has proved itself in all the trials carried out at Aberystwyth to be

very much more productive than Dutch even in the first harvest year. In these trials the only period in which Dutch surpassed Wild white was in the seeding year. In practically every trial the Dutch white plots had become very thin by the first harvest year and by the second harvest year nearly all the plants had disappeared altogether. When sown at the rate of one to two lb. per acre Wild white formed by the first harvest year a dense leafy sward which not only produced a good deal of first-rate grazing, but also helped very considerably in keeping out weeds. Being a very aggressive plant Wild white will produce an excellent sward for a large number of years provided the pasture is supplied with an occasional dressing of phosphates and that the grazing is properly managed.

In many respects New Zealand white clover is intermediate between Dutch and Wild white. It invariably produces a far denser and better sward than Dutch. Although it is not so aggressive as Wild white, it is, however, by virtue of the more rapid growth and the fact that it has a longer growing season, more productive than Wild white in the first harvest year. Some of the samples of New Zealand white harvested from very old leys have actually given more growth than Wild white in the second harvest year, but generally speaking the New Zealand white becomes rather thin by the third year and disappears almost completely by the fourth year.

Ladino is a very early and quick growing variety grown in Italy. It is even shorter lived and less hardy than Dutch white, it is therefore fortunate that only very small quantities of this seed are imported into this country. Except, possibly, on land which is known to be highly propense to white clover, Wild white should be sown in all leys laid down for more than two years. For one or two year leys New Zealand white should always be sown in preference to Dutch white.

It is estimated that about 500 to 600 tons of white clover seeds were sown in Britain last year; of this enormous amount only about 70 tons, that is about one-eighth of the total, was Wild white. The remainder, with the exception of about 20 to 25 tons from New Zealand was Dutch white obtained chiefly from Holland, Germany and Poland, together with a small amount of home-grown Dutch. It is very unfortunate that the price of Wild white clover is so high. It would confer an inestimable boon on farmers in general, and would enormously add to the wealth of the country, if Wild white were placed on the market on a sufficiently large scale to bring the price within the reach of every farmer. As the yield from old permanent pastures must of necessity be small, our only hope is to increase considerably the annual supply of " once grown " Wild white. Provided the stock seed is obtained every time from old permanent pastures " once grown " Wild white seed is in every way as good as the original seed.

SOIL ACIDITY CONSIDERED FROM THE POINT OF VIEW OF BASE EXCHANGE AND HYDROGEN ION CONCENTRATION.

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Introductory.

It is unnecessary to elaborate on the importance of the problem of soil acidity in agricultural development. The farmer ordinarily recognises an acid soil as a sour soil; and the correction of soil sourness or acidity by the neutralising action of lime or marl has been one of the main steps in the reclamation of land for agricultural purposes from practically pre-historic times. It is commonly supposed that the best agricultural land must necessarily contain a certain amount of lime or calcium carbonate. Hall (29)* recommends in a general way the application of lime when the carbonate content of the soil falls below 1% $CaCO_3$. It may be stated, however, that in spite of a very considerable amount of scientific investigation both in Europe and in America we still await a precise and satisfying solution of the quantitative lime-requirement of any given soil for maximum crop production.

It is important to emphasise at an early stage that in any rational and economical system of soil fertilisation soil differences must be recognised and admitted. It may be possible for a given quantity of a particular commercial fertiliser to give increased remunerative yields on *any* soil; it is quite unlikely that lime will invariably do so. Peat soils which have not been limed within living memory are practically certain to give increased returns from liming. Limestone drift soils which sometimes contain as much as 10% of calcium carbonate could not reasonably be expected to benefit by any application of carbonate. On the other hand, instances have been recorded of injury being caused by liming, chiefly on old pastures and on land where potassium manures had previously been freely used.

In practice it is always possible for the farmer, by means of field trials, to arrive at an estimate of the lime-requirement of any soil or soils with which he has to deal. Proper field trials, however, involve not only cost and time but a certain degree of technique which is not always forthcoming. Much as it may be desirable for the individual farmer to experiment, a solution of the problem on these lines involves a general repetition of the cost of experiment on the majority of farms, with virtually no resultant contribution to the fundamental solution of the general problem. On the other hand, a proper knowledge of the relationship of lime to soil fertility would enable the soil analyst to indicate whether, and to what extent, a particular soil required liming. The present review of the subject, and the experimental work to follow, were undertaken with the ultimate aim of seeking a solution for the problem on these lines.

*Bracketed numbers relate to list of references at end of article.

It is to be admitted that the hopes of fifty or sixty years ago as regards the prediction, by analytical methods, of the fertilizer requirements of the soil are still not quite realised. Lime requirement, however, does not enter, strictly speaking, within the category of ordinary manurial requirements. The aim in view in liming is not, except in very exceptional instances, to furnish the soil with calcium as a plant food, but rather to correct an undesirable physico-chemical condition which exists in certain soils. For the correction of soil acidity, in countries where limestone exists in bulk, no truly economical substitute for lime is known to exist. A notion has actually arisen that the application of lime has ceased to be an economical proposition because of the competition of modern fertilizers. It is possible for a fertilizer such as basic slag to give particularly good results on acid soils solely because of its basic nature; but its basic nature is mainly due to its lime content which varies from 30-40% CaO. In a case where the chief need of a soil is lime it seems somewhat undesirable to purchase it at the price of slag. It is true that the purchase of slag includes a valuable phosphate. As will be mentioned later, phosphatic manures, even of apparently acid nature such as superphosphate, have been found to counteract the toxicity which acid soils display to certain crops. It remains to be proved whether the action of phosphatic manures in this respect is more than temporary.

In the present article it is proposed to deal with various theoretical aspects of the problem of soil acidity with the primary object of deciding, at least in a general way, the nature of the lime requirement of the soil for maximum plant growth. The main features of the natural process of soil acidification will be first referred to, together with the relation between this process and the phenomenon of base exchange. Subsequent to this the measurement of soil acidity in terms of hydrogen-ion concentration will be treated of, and finally, the relationship between plant growth and soil acidity, as measured in terms of hydrogen-ion concentration.

Loss of Bases in the Formation of Soils.

Chemical investigations on the weathering of primitive rocks in the course of soil formation reveal the fact that a considerable quantity of metallic or basic material is lost in the process. The mode of weathering has naturally been dependent on the climatic conditions which prevailed while the action was in progress. Various agencies, mechanical, physical, biological and chemical, have assisted in the weathering process. For the moment we are concerned merely with the chemical agencies which, briefly stated, consisted of the hydrolytic action of water and the more energetic action of water containing dissolved carbon dioxide. By the action of carbonated water on the rock silicates, metals such as calcium, magnesium, potassium and sodium were in part removed as bicarbonates and carbonates. While much of the calcium and magnesium was redeposited in the soil or in sedimentary rock formations most of the sodium and potassium was leached away. In relatively arid climates, where the rainfall was insufficient to wash away the bulk of the sodium salts resulting from rock weathering, alkaline soils have resulted. These soils, which occupy con-

siderable portions of the United States, Russia and Hungary, etc., have proved much more difficult of reclamation than the acid soils with which we are familiar under humid conditions.

It is of interest to note in passing that excessive accumulation of sodium has a similar effect on the soil to that due to the excessive removal of calcium in that the resultant soil is deflocculated and relatively impermeable. The action of soda here is quite comparable to the effect produced by continuous use of nitrate of soda as a fertilizer, as pointed out in 1907 by Hissink (33) and in 1909 by Hall (30). The flooding of a clay soil by sea-water tends to produce a similar result.

That the process of soil formation involved the displacement of much of the basic material from the original rock silicates does not imply that the original silicates were necessarily alkaline. The carbonates of sodium and potassium are alkaline, but these salts are evidently formed subsequent to the displacement of the metallic ions in the weathering process. Excess of sodium or potassium carbonates are ultimately removed from the soil if rainfall be sufficient. It may be stated as a general rule that calcium and magnesium are much more readily displaced from combination in silicates than are sodium or potassium, but once displaced the former elements tend to remain in the soil in the form of relatively insoluble carbonates. It is on the tendency of calcium, and to a lesser extent of magnesium, to accumulate in the soil as carbonate that the process of soil acidification is primarily slowed down at a point approximating neutrality, and it is on the extent to which carbonate has accumulated that the soil will be capable of maintaining a neutral condition over a long or short period of time. This point will be treated further in some experimental work to follow.

The considerations so far advanced serve to throw light on the accumulation of lime in the process of soil-formation from primitive rocks in situ. It will readily be seen that under certain geological circumstances the lime content of the soil may owe more to geological soil displacements, particularly where, through glacial action or otherwise, the disintegration products of sedimentary calcareous formations have intermingled with it as is the case in many parts of Ireland.

Rôle of Organic Matter in Soil Acidity.

There is considerable evidence to lead to the belief that the continuous action of carbonated water on finely-divided rock material would explain the ultimate development of an acid soil, but there are yet other factors to be considered. Vegetable matter invariably possesses an acid reaction. This is equally true of the growing plant as it is of the decomposition products of the plant. The humus of the soil is derived from decayed vegetable matter. The belief was once prevalent that humus was the main cause of soil acidity. This is undoubtedly true in the case of peat soils where it is abundant, but, on the other hand, there exist soils which are practically devoid of organic matter and which are nonetheless distinctly acid. There is evidence of a recent tendency on the part of soil investigators to consider what are termed "inorganic" and "organic" soil

acidity as problems apart. This is due, perhaps, to the fact that for the time being, at least, the acidity of the inorganic soil complex has proved the more interesting problem.

RELATION OF BASE EXCHANGE TO SOIL ACIDITY.

The knowledge of the soil phenomenon of base exchange dates from the researches of Way in 1850. Way set out to investigate the then known absorptive power of the soil for ammonia. It was known that not only did the soil absorb free ammonia, but it also possessed the power of removing it from its salts. Way succeeded in demonstrating that the soil could likewise absorb other bases such as calcium, magnesium, potassium and sodium even from combinations of these substances with strong acids. When the base was absorbed from a salt, the acid remained in solution in the form of a salt of a base displaced from the soil. In seeking an explanation for these interesting facts Way prepared an artificial double silicate of sodium and aluminium. He found that the sodium in this substance could be practically completely replaced by calcium on treatment with calcium salts, that the calcium in turn could likewise be replaced by potassium and the potassium by ammonium.

Relatively little is known of the complex colloidal silicates present in the soil, but there is very little doubt that substances of the type of that synthesised by Way are, in reality, the soil constituents mainly concerned in base exchange. A close study has been made of various silicates which manifest this phenomenon (the zeolithic silicates and the permutites, for instance), and the following laws have been fairly definitely established:

1. In a neutral soil, base exchange takes place in equivalent proportions, i.e., for a given quantity of any base absorbed an equivalent quantity of another base or bases is displaced.

2. The amount of base displaced depends on the concentration of the displacing solution. The exchange is reversible and consequently is never complete unless the displaced base is continuously removed. It has been shown by Gedroiz (21) and by Hissink (34) that base exchange thus conforms with the principles of mass action and chemical equilibrium.

3. The silicates studied have each a definite point of saturation beyond which no further absorption or exchange takes place.

4. The different basic ions differ considerably in replacing activities. It would appear that their activities are in the following order: $Ca > Mg > K > NH_4 > Na$. There is a similarity in the ease with which a metallic ion enters the exchange complex with the readiness with which it can be displaced.

5. Base exchange appears to be a property common to all soils containing the colloidal inorganic fraction commonly classified as clay.

The question now arises as to the manner in which base exchange is concerned with soil acidity. The relationship lies in this: that the electro-positive hydrogen-ion behaves in a manner similar to the electro-positive metallic ions which take part in base exchange; not only that, but the

replacing activity of the hydrogen ion is much greater than any of the metals mentioned, and it should consequently be placed before calcium in the series given above.

A clay will acquire an acidity when part of its exchangeable bases have been replaced by hydrogen ions. A necessary consequence of the replacing activity of hydrogen ions is that while bases displace each other in equivalent proportions in neutral soils they will not do so in acid soils. This is due to the fact that in an acid soil part of the displacing base is utilised in displacing hydrogen ions. If, for instance, a neutral soil be treated with a solution of sodium chloride, the sodium will displace equivalent quantities of other bases, notably calcium, yielding chlorides of the displaced bases in the resultant solution; if the soil be originally acid, part of the sodium will displace hydrogen ions, yielding free hydrochloric acid in the final solution. Solutions of fertilisers such as chloride or sulphate of potash would similarly give rise to free mineral acids in a soil which was originally of acid reaction. The treatment of soils with neutral salt solutions in the manner described formed the basis of the earlier attempts to estimate soil acidity and determine lime requirement. Extracts of even very acid soils made with pure water yield extremely small quantities of titratable acid, while extracts made with neutral salt solutions yield considerable titratable acidity which was supposed to be approximately proportional to lime requirement. It may be mentioned that strong acids formed from neutral salts readily dissolve aluminium and iron from the soil, but the formation of these salts does not hinder titration.

A further consequence of the replacing activity of hydrogen ions is that the bases normally present in soil silicates are readily displaced by acidic hydrogen. Free hydrogen ions are produced by all acid substances so that free organic acids or carbon dioxide when present in the soil in association with base exchanging silicates must ultimately induce an acid condition in the silicates because of base displacement. While therefore a peat or sandy soil may owe its acidity exclusively to the presence of organic acids, the acidity of a clay soil must necessarily be shared by the clay.

Relation of Base Exchange to Plant Nutrition.

It is a well known fact that, even after a soil has been treated with potassium or ammonium salts, the soil solution is found to contain extremely small concentrations of potash and ammonia. Ordinary applications of either of these fertilizers are nearly completely absorbed by the soil colloids. It was formerly commonly assumed that since the absorption of potassium and ammonium involved the displacement of calcium into the soil solution the presence of calcium carbonate was necessary to enable the exchange to take place. It has been definitely established, however, that the presence of calcium carbonate is not necessary for this purpose. The calcium which appears in the soil solution is directly derived from the soil colloids. Since the plant requires its nutrients in soluble form it follows that when the very small quantity of potash in the soil solution is absorbed by the plant roots, or when the ammonia is nitrified, some mechanism must exist whereby the supply of potash and ammonia in the soil solution is

continuously replenished. If the soil colloids are allowed to absorb basic plant nutrients such as potassium, calcium or magnesium, and if the product is washed free from dissolved salts it now fails to yield the absorbed elements to the plant unless salts are added, the basic ions of which are capable of displacing the absorbed plant nutrients from the colloids. Kellner (41) found that plants were unable to utilise either potash, calcium or magnesium unless these were present either in soluble form or else absorbed in contact with saline solutions in which base exchange could readily take place. Prianischnikow (57) following Kellner's technique in the use of exchanging saline solutions found a parallelism between the growth promoting properties of various potash-containing minerals of common occurrences in soils and the freedom with which the same minerals yielded potash in base exchange. Ramann (59) working with permutite, an artificial silicate which is capable of base exchange, found that when some of the necessary plant nutrients were combined in the silicate, plants failed to grow unless other exchanging bases were also present in solution. Ramann observed further that silicates which were incapable of base exchange failed to yield nutrients to the plant even in the presence of other saline solutions.

These results indicate the importance of base-exchanging soil colloids to plant growth. They show, moreover, that though a soil may be abundantly supplied with basic plant nutrients, as determined even by the more refined analytical methods of recent years, if the relatively simple conditions essential to the liberation of these bases for the use of the plant be absent, the analytical results must necessarily be illusory.

Base absorption by exchanging silicates is never complete. Under any given set of conditions there appears to exist a definite state of equilibrium between the bases present in the silicate and a definite concentration of the bases present in the solution. If the concentration of the solution be altered so as to increase or diminish the concentration of any absorbable ion present, the silicate will react to establish a new equilibrium under the new conditions; but the silicate will not release its absorbed ions unless others be forthcoming to take their place. Herein lies the evident importance of a reserve of calcium in the soil; but it is possible to visualise soil conditions under which nitrate of soda or sodium chloride, for instance, would be of benefit to a crop because of its sodium, through liberation of soil potassium.

The replacing activity of the hydrogen ion opens another side to the question. Since the hydrogen ion is capable of displacing basic ions from exchanging silicates it follows that had a dilute acid been used in place of the displacing saline solutions in the experiments of Kellner, Prianischnikow and Ramann, plant growth should have been likewise possible. This point does not appear to have been directly investigated. It seems probable, however, that, once the reserve of lime in the soil is exhausted, the formation of acids in the soil by the usual biological processes may not only be sufficient but also necessary for the displacement of a supply of basic plant nutrients. The progressive acidification of the soil would thus necessarily be linked with plant growth under these conditions.

The next section of the work will deal with the measurement and influence of the actual acidity or hydrogen-ion concentration of the soil. Before proceeding, mention may be made of recent work by Robinson and others on the interrelation between base exchange and lime requirement. It is proposed to reserve a discussion of this subject until further aspects of the question have been considered.

In conclusion, a final aspect of base exchange bearing on the practice of liming may be mentioned. In certain cases the base exchanging soil colloids may be relatively rich in bases such as potassium, sodium and ammonium and at the same time relatively poor in calcium. In such cases heavy applications of lime may tend to release abnormal quantities of sodium or potassium with the production of unduly caustic conditions in the soil, the hydroxides of sodium and potassium being much more soluble and caustic than that of calcium. The danger in this respect is greater when burnt lime rather than ground limestone has been used. Though damage to freshly-limed soils from this cause may be relatively rare, the danger is none the less real in the heavy liming of soils containing much easily replaceable sodium or potassium, a condition which is quite likely to arise in a soil which received heavy recent dressings of potassium fertilizers.

THE MEASUREMENT OF ACTIVE ACIDITY OR HYDROGEN-ION CONCENTRATION.

Before proceeding to deal with the measurement of a substance or of a property it is useful to define what we intend to measure. In the case of soil acidity a definition is all the more advisable because the application to soils of the term " acidity " has been questioned repeatedly in the past. The chemist of last century gave the generic title of " acid " to certain substances which had particular well-defined qualities in common. Inevitable difficulties arose in dealing with substances which possessed some of these properties, but which lacked others. For instance, acid soil lacks many of the clearly defined properties which sulphuric, nitric and acetic acids all possess in common; in fact the assumption of the acidity of certain soils seems to have been nearly entirely based on their reacting after the manner of other acids with litmus and similar indicators. The ambiguity of the situation was further increased by the fact that the behaviour of a soil which changed the colour of an indicator admitted of an explanation other than that which assumed the soil to contain free acid. A plausible theory of the behaviour of indicators is that the change of colour which they exhibit on passing from an acid to an alkaline medium is due to salt formation on the part of the indicator itself. If the soil, merely because of the colloidal nature of some of its constituents or because of poverty in basic material, selectively absorbs the base from the indicator the net result will be the same as though we had brought the indicator in contact with an acid. This aspect of the question led many to doubt the true acidity of any soil in the belief that the properties observed in so-called acid soils could be amply explained by selective absorption of bases by the soil colloids. The case of absorption of bases from

neutral salt solutions has already been referred to and serves to illustrate this point. It is to be noted that this conclusion does not appear far removed from Gedroiz's recent definition of an acid soil as a soil unsaturated with regard to bases. The present-day general acceptance of the term "acidity" as applied to soils is due to relatively recent advances which have enabled us to define precisely what acidity consists of and to the fact that acid soils conform with this definition.

The common laboratory acids have all certain points of resemblance. They all form salts with another group of compounds which we term alkalis, in which process acidic properties disappear. They more or less readily attack various metals; they catalyse the inversion of cane sugar and the hydrolysis of organic esters, etc. These common properties have been traced to a common cause, viz., the presence of relatively large amounts of free hydrogen-ions in acid solutions. The greater the concentration of hydrogen-ions present in the solution of any acid, the more strongly will that solution show acidic properties. For example, 36.5 grams of hydrochloric acid, though capable of being neutralised by the same quantity of an alkali as would be necessary to neutralise 60 parts of acetic acid or 284 parts of stearic acid, displays very much greater active acidity than would be displayed by the larger concentrations of either acetic or stearic acids. The difference is due to the fact that hydrochloric acid is capable of producing a much greater concentration of free hydrogen-ions in a given volume of solution.

Alkalis or bases, on the other hand, are characterised by the power of producing hydroxyl ions. When a solution of an acid is treated with a base the concentration of hydrogen ions due to the acid is progressively reduced until finally, if excess of the base be added, hydroxyl ions predominate. Intermediate between these two stages we have neutrality.

The state of neutrality is best typified by pure water. The purest sample of water hitherto prepared was found to possess a slight electrical conductivity and this would appear to be due to a certain degree of ionisation. From the extent of the conductivity observed it was calculated that a ton of pure water contains about 1.8 milligrams of hydrogen and hydroxyl ions in equivalent proportions. In other words, the concentrations of hydrogen and hydroxyl ions in pure water at 25° is of the order 10^{-7} normal or $\frac{1}{10{,}000{,}000}$ gram-atom or gram-molecule of each to the litre. If we apply the laws of chemical dynamics we find that the product of the hydrogen and hydroxyl ions must be a constant. Hence, if the concentration of the hydrogen ions be increased through the introduction of an acid, the concentration of hydroxyl ions must proportionately diminish, so that in a litre of an aqueous solution at 25° we have

$$H^{+} \times OH^{-} = 10^{-7} \times 10^{-7} = 10^{-14}.$$

If, for instance, we have a solution containing 1 gram-atom of hydrogen ions per litre, the concentration of hydroxyl ions in this solution would automatically be reduced to 10^{-14} of a gram-molecule, and vice versa.

If the concentration of hydrogen ions exceeds 10^{-7}, or one-tenmillionth of a gram-atom per litre, then we are dealing with an acid solution. The

determination of hydrogen-ion concentration enables us to define acidity with precision. It enables us, moreover, to measure acidic strength or active acidity.

In dealing with hydrogen-ion concentrations a conventional system has been universally adopted whereby the inverse of the logarithm of the concentration is employed, the number so obtained being prefixed by the symbol pH. Under this system a hydrogen-ion concentration of 10^{-7} gram-atoms per litre is written pH 7, a hydrogen-ion concentration of 10^{-10} would be written pH 10, while a solution containing 10^{-5} gram-molecules of *hydroxyl* ions per litre would be written pH 9. This notation, though now generally adopted, is not quite satisfying. One of its disadvantages, particularly to those who are unfamiliar with it, is that increasing concentrations of hydrogen ions are indicated by decreasing numerals. Thus it will be noted that pH 6 is less acid than pH 5, and pH 3 is more acid than pH 4.

A detailed description of the various methods in use for the estimation of hydrogen-ion concentration would require of too elaborate a treatment to find a place in the present review. The subject is amply dealt with elsewhere by Clark (13). Two methods of estimation are available, viz., electrometric and colorimetric. The electrometric method is the more accurate, but it involves the use of relatively expensive apparatus. In electrometric measurements of pH we may use either the hydrogen electrode or the quinhydrone electrode. The principle of the hydrogen electrode is best explained on the basis of Nernst's theory of electrolytic solution tension. If we place a metal in contact with a solution of one of its salts there exists a difference of electrical potential between the metal and the solution in accordance with the concentration of the ions of that particular metal in the solution. If we have two solutions of a metallic salt of different concentrations, strips of the metal placed in each will acquire different potentials proportional to the ionic concentrations; and if the solutions be connected by means of a salt bridge an electric current will be obtained by connecting the metals outside the solution. If we know the concentration of metallic ions in one solution, the potential difference between the two metals would enable us to calculate the concentration of metallic ions in the second solution. Not only do metals behave in this manner relative to their ions, but various gases are found to act in a similar manner when means are devised to enable them to be handled in the same manner as metals. Hydrogen is readily absorbed by metals such as platinum or palladium and when in an absorbed condition it behaves towards its ions just as a metal would do. This, in brief, is the principle of the hydrogen electrode. When a hydrogen electrode which contains a solution of unknown hydrogen-ion concentration is connected through a potentiometer and a galvanometer with a similar electrode of known potential, then we can calculate the hydrogen-ion concentration from the potential difference observed between the two electrodes. For convenience in practice, a standard calomel electrode is generally used in place of the standard hydrogen electrode.

The estimation of the hydrogen-ion concentration of a solution is more

conveniently carried out by means of the quinhydrone electrode which was introduced for the purpose by Einar Biilmann of Copenhagen in 1921. When a strip of platinum or gold foil is immersed in a solution of quinhydrone it immediately acquires a definite electrical potential which is independent of the concentration of quinhydrone, but is directly proportional to the hydrogen-ion concentration of the solution. Here again, if we have one electrode of known pH we can estimate the concentration of another by connecting them as before. In finding the pH of a soil, for instance, it is only necessary to add a little quinhydrone to the moist soil, to immerse a strip of clean platinum foil in it, and to connect up with a standard quinhydrone or calomel electrode. The necessary readings may be taken almost immediately. With the hydrogen electrode a single reading may sometimes occupy a couple of hours.

While the electrometric estimation of hydrogen-ion concentration requires somewhat expensive electrical apparatus, the colorimetric method, on the other hand, is within the resources of practically any laboratory. In volumetric analysis the neutralisation points of acids and alkalis are determined by means of substances known as indicators. These are merely organic substances, such as methyl orange or litmus, which have the property of exhibiting a different colour according to the acidity or alkalinity of the medium in which they are placed. Contrary to a rather common belief, very few indicators indicate neutrality. They each change colour within particular limits of hydrogen-ion concentration, which limits vary on the scale of acidity from pH 1 to pH 13, according to the indicator chosen. From the point of view of hydogen-ion concentration, the rate at which any indicator changes colour is relatively gradual. As a rule, the transition stage of the colour change of any one indicator is spread over about two pH units, the difference in the degree of colour due to variation of 0.2 pH units being quite distinct. In seeking the pH of a solution by the colorimetric method it is first necessary, by a little speculation, to find the indicator within the transition stage of which the pH of the solution under observation may happen to lie. By then comparing the degree of colour given by a definite quantity of this indicator either with a standard colour chart or preferably with colours given under similar conditions by the same indicator with so-called buffer solutions of known hydrogen-ion concentration it is possible to determine the pH of the solution under examination to within 0.1 or at most 0.2 pH units. Gillespie (23) has devised a system in which, by using varying quantities of the indicator, the use of standard buffer solutions may be dispensed with.

The relative merits of the methods thus briefly described have been the subject of study by various workers. In general, it may be said that while the electrometric methods are more accurate, the colorimetric method has invariably given results in substantial agreement with the hydrogen electrode with which it has usually been compared. In dealing with soils the hydrogen electrode itself is not beyond reproach. Estimations by this method occupy considerable time and throughout each estimation it is necessary to pass hydrogen continuously through the soil suspension. This involves the removal of carbon dioxide which, in soils which are nearly

neutral, must inevitably influence hydrogen-ion concentration. The quinhydrone electrode is free from this objection, but in either electrometric method, where a substance of such heterogeneous composition as soil is concerned, one must continuously guard against the danger of the so-called "poisoning" of the platinum electrodes. Owing to the oxidation of quinhydrone in alkaline solutions it cannot be used for measurements on the alkaline side of pH 8.5, but none but very alkaline soils pass this point. The colorimetric method fails completely in the case of soils which do not give clear aqueous extracts. Not only is difficulty encountered in observing the colour of the indicator in such cases, but suspended colloidal matter may remove the indicator from solution and thus produce a false colour. It is very advisable to avoid filtration in preparing the soil extract, but many soil suspensions do not clarify even on filtration in which case the use of a high-power centrifuge is a last resource.

The Hydrogen-ion Concentration of Soils.

According to the available data the hydrogen-ion concentration of the soil seems to lie within the limits pH 3.5 – 9.5. Gillespie (24) examined a number of specimens of American soils and found their concentrations to lie between pH 4.4 and 8.6. Sharp and Hoagland (63) found American samples as acid as pH 3.7 and as alkaline as pH 8.0. Hissink and Van der Spek (35) made a study of the hydrogen-ion concentrations of Dutch soils and noted that those containing calcium carbonate were usually somewhat alkaline, with an average reaction of pH 7.5. Pratolongo (56) made a study of Italian soils and observed that those which were conspicuously fertile had a hydrogen-ion concentration which lay between the limits pH 6.6 and 7.8. He noted that while the percentage of the more important plant nutrients varied within very wide limits without any apparent relation to soil fertility; on the other hand, when the hydrogen-ion concentration falls below pH 6.4 and oscillates between pH 4 and 5, the fertility falls to its lowest limits. Relatively few data are available as regards the hydrogen-ion concentrations of Irish soils. Samples from the University farm at Glasnevin lie between pH 7 and 8, while others taken from Meath pastures are found to be more acid at pH 6-7. Specimens sampled over old Red Sandstone in Co. Fermanagh were as acid as pH 4.9, while Atkins (5 and 6) reports values between pH 4.1 and 8.8 for Co. Cork soils.

These figures are quoted merely for the purpose of illustrating the degree of acidity or alkalinity which one might expect in naturally occurring soils. It is probable that the vast bulk of Irish soils lie between the limits pH 4 and pH 8. The idea has been more or less prevalent that the relative infertility of acid soils is due to the direct action of acid on the plant itself. It will be apparent that this is extremely unlikely when it is noted that the acidity of the sap of the average healthy plant lies between pH 4 and pH 6. Moreover, a plant will usually grow quite well in a culture solution which is much more acid than the average acid soil. While there is evidence that plant growth is directly influenced by variations in the acidity of a water culture, the case is necessarily complicated when the culture medium is soil, owing to the influence of acidity on the properties of the soil. One of

the chief undesirable features usually associated with acid soils is deflocculation or lack of crumbling. This seems due rather to lack of the flocculant calcium than to the concentration of hydrogen-ions. A sufficiently large concentration of hydrogen-ions would suffice to cause flocculation, but the cure in this case would be a greater evil than the disease. In the next section it is proposed to consider the influence of acidity on the fertility of the soil and to show to what extent under agricultural conditions the plant may be influenced, both indirectly and directly, by soil acidity.

THE RELATION OF THE HYDROGEN-ION CONCENTRATION OF THE SOIL TO PLANT GROWTH.

The hydrogen-ion concentration of the soil is a measure of the active acidity of the soil. Active acidity is distinct from the total or titratable acidity. The latter refers only to the quantity of acid present while the former refers to the strength of the acid, irrespective of quantity. When we come to consider various aspects of the relationship between the acidity of various soils and plant growth we find, as a rule, that active acidity or hydrogen-ion concentration, rather than total acidity, is the controlling factor in this relationship. The application of lime to an acid soil will cause a reduction in hydrogen-ion concentration. In so far as a relationship exists between the fertility of a soil and its hydrogen-ion concentration, the measurement of the latter ought to indicate whether an application of lime be necessary; but a single measurement of pH will not indicate the *quantity* of lime necessary, because no general relation can be said to exist between the hydrogen-ion concentrations of soils and their total or titratable acidity. If, as is commonly assumed, " lime requirement " means the quantity of lime necessary to render a soil neutral, then a knowledge of the total acidity of the soil would be necessary for the estimation of " lime requirement." Ordinary chemical methods for estimating total acid are quite impracticable when applied to soils. The most feasible method at present available consists in the study of the influence of lime on the hydrogen-ion concentration so as to determine the quantity necessary to reduce this concentration to a necessary minimum. Whether this minimum corresponds to neutrality in all cases remains for investigation.

One of the most unfortunate aspects of the soil-acidity problem at the moment lies in the manner in which the term " lime requirement " is used. The confusion is most simply explained by the fact that the fundamental aspects of the problem are not understood. The agriculturist asks for an estimate of the amount of lime necessary for maximum crop production on any given soil. This would be a simple and clear definition of the problem were it not that it implies a fallacious assumption: that the crop concerned is a matter of indifference. Truog in 1918 (64) rightly pointed out that the question of the lime requirement of soils was intimately dependent on what he termed the lime-requirement of the crops which were to be grown on these soils. Certain crops will respond to lime on a particular soil while others, on the same soil, will give no response. This is a fundamental consideration. One worker may test a lime-requirement method and recommend it for adoption because increased yields were obtained with clover

or beet while another may condemn it because no increase was obtained with oats, potatoes or rye. Increased confusion is likewise due to the fact that innumerable methods have been put forward for the determination of lime-requirement. It is nearly a general rule that the results of no two of these methods ever agree. In spite of this we find that when a particular method has been applied to a soil the result is usually dogmatically called the " lime-requirement " of that soil, irrespective of the fact that had any other method been used the " lime-requirement " would often have been entirely different. Some of these methods, none the less, have proved to be valuable guides in liming, and it is proposed to discuss them later in the light of the present general review of the fundamental aspects of the problem.

In approaching the consideration of the effects due to lack of lime in the soil from the point of view of relationship with hydrogen-ion concentration it is to be noted that lack of lime is known to have a detrimental influence on bacterial activity in the soil, particularly on nitrification and nitrogen fixation. It is said to influence the solubility of plant nutrients and the solubility and activity of plant poisons. Recollecting that the supply of lime controls the hydrogen-ion concentration of the soil, the intimate relation between these and other factors influencing plant growth will now be considered under the following heads:

1. Influence of hydrogen-ion concentration on bacterial activity in the soil—
   (*a*) nitrification
   (*b*) denitrification
   (*c*) ammonification
   (*d*) nitrogen fixation
   and (*e*) plant diseases.
2. Influence of hydrogen-ion concentration on the supply of plant nutrients.
3. Influence of hydrogen-ion concentration on the activity of plant poisons in the soil, and
4. Direct influence of hydrogen-ion concentration on the growth of plants.

1. Influence of Hydrogen-ion Concentration on Bacterial Activity in the Soil.

It is an established fact that the growth of micro-organisms is intimately linked with the hydrogen-ion concentration of the medium in which they grow. For each organism there is a particular hydrogen-ion concentration at which growth and activity is greatest. This is known as the " optimum reaction " for that particular organism. Secondly, it is found that an organism only manifests its activity within certain limits of hydrogen-ion concentration, which limits vary for each type of organism. Precisely

similar generalisations apply to enzymes or ferments, on the activity of which most biochemical processes depend.

In the vital fluids of the normal plant or animal we usually find hydrogen-ion concentration remarkably adjusted in favour of the enzymic reactions which take place in the particular juice concerned. Human saliva, for instance, has a concentration corresponding to pH 6.9. Starch undergoes preliminary digestion in the saliva under the action of the enzyme ptyalin which has an optimum reaction of pH 6.7. Proteins are digested in the gastric juice by pepsin which has an optimum reaction of pH 1.4. The reaction of gastric juice normally lies between pH 0.9 and pH 1.6. The reaction, or pH, in various parts of the living organism is maintained practically constant through the action of substances such as proteins, bicarbonates and phosphates which are described as having a "buffering" action. The soil is also highly buffered, but this aspect of soil chemistry will be specially dealt with in a later paper. For the moment we are concerned with the reaction conditions necessary to the bacterial activities on which efficient plant growth depends.

(a) *Nitrification.*

The activity of nitrifying organisms has been shown to be intimately connected with hydrogen-ion concentration. The production of nitrate from ammonia in the soil is accomplished through the production of nitrite as an intermediate stage. Meyerhof (50) found the optimum reaction for nitrite formation to lie between pH 8.4 and pH 8.8 and for nitrate formation he gives pH 8.4-9.3 as optimum. Gaarder and Hagen (19) of Bergen hold the belief that the soil contains different species of nitrifying organisms. They found different strains of nitrite-forming organisms in the soil, some of which had an optimum reaction at pH 7.7-7.9, with a limit of activity at pH 7.0, while others had an optimum of pH 6.5-6.6 with a lower limit of activity at pH 6.0. These authors found the optimum reaction for the production of nitrate from nitrite to be pH 6.8-7.3. Nagan Gowda (27) found the optimum for nitrite formation to be near pH 8.0 and for nitrate formation to be between pH 8.5 and 8.8.

In general these results indicate that nitrification is best when the soil is somewhat alkaline, but the data as a whole lack precision. It is quite possible, as Gaarder and Hagen suggest, that different strains of organisms may take part in the same process, or it may even be possible for the same organism to adapt itself gradually to different degrees of acidity. The most notable feature of the above observations which, it is to be noted, were made on artificial cultures, is that the limit of activity is reached when the medium becomes but slightly acid. It was once generally believed that nitrification was practically absent in acid soils and the results of the bacteriologists quoted would appear to confirm this view. However, observations made directly on soils indicate that a very considerable amount of nitrification takes place under distinctly acid conditions in the soil itself. (Compare Brown and MacIntire (8), White (69), Fraps (17), Noyes and Connor (54), Hoagland (36) and Lipman, Prince and Blair (43)). When we recollect the heterogeneous nature of the soil, it is

possible to conceive of special regions of relative alkalinity where nitrification could still take place even in a soil which was generally acid. Such regions are inevitable in the neighbourhood of particles of calcium carbonate, should these be present. At the same time the facts so far brought to light do not exclude the possibility of a certain degree of nitrification under uniformly acid conditions. Gerretsen (22) states that nitrification is not entirely inhibited until pH 3.9 is reached, while Gaarder and Hagen record the occurrence of nitrification at pH 4.8. Waksman (66) states that the production of nitrate from sulphate of ammonia in the soil ceases only when the reaction falls below pH 4.8.

(b) *Denitrification.*

While a moderate degree of alkalinity in the soil is undoubtedly specially favourable to nitrification, Zacharowa (72) has shown that denitrification takes place most readily under somewhat similar conditions. In the study of denitrification in culture solution he found the optimum reaction to lie between pH 7.0 and 8.2, while he found the limits of acidity and alkalinity at which the action ceased to be pH 5.5 and pH 9.8 respectively.

(c) *Ammonification.*

The number of organisms in the soil which are capable of producing ammonia is innumerable and mainly in consequence, specific figures relating to the influence of reaction or acidity on ammonification are not available. General observations on soils show that ammonification is *apparently* greatest in the absence of lime. This is very probably due to the accumulation of ammonia owing to the diminished activity of nitrifying organisms under acid soil conditions.

(d) *Nitrogen Fixation.—Legume Bacteria—Azotobacter.*

It is generally agreed that the organisms which assimilate gaseous nitrogen are intolerant of acid soil conditions. Bewley and Hutchinson (7) show that most species of legume bacteria grow best at a neutral or slightly alkaline reaction. Fred and Davenport (18) investigated the influence of reaction on nitrogen assimilating bacteria and found that those which act symbiotically with leguminous crops ceased to grow at the acid limits stated.

	acid limit	
1. Alfalfa and sweet clover	pH	5.0
2. Gardenpea, sweet pea and vetch	pH	4.8
3. Red clover and common bean	pH	4.3
4. Soybean and velvet bean	pH	3.4
5. Lupines	pH	3.2

While no specific data appear to be available for the optimum reactions of these bacteria, the bulk of the evidence indicates that leguminous crops grow best and produce the maximum number of nodules at pH 7-pH 8, that is, at neutrality or at a light alkalinity. The results of Lipman and Blair (44) and of Morse (53) indicate that when legumes are grown on an acid soil the addition of lime causes not only an increase in yield but also an increase in the nitrogen content of the crop.

It is generally accepted that, among the non-symbiotic nitrogen-fixing bacteria so far studied, the azotobacter group are probably the most important from the point of view of fixing nitrogen under average soil conditions. There are, however, many soils in which azotobacter do not exist and this led in former years to attempts at inoculation. The results of inoculation trials at various centres led to no convincing result. In 1925 Gainey (20) found that it was impossible to establish an azotobacter flora by inoculating a soil in which it did not previously exist and he found that this was due to the acidity of the soil. When the hydrogen-ion concentration was brought above pH 6.0 an apparently permanent azotobacter flora became established. When the soils were again allowed to become more acid than this the azotobacter died out.

The presence of azotobacter in the soil is considered by many to be a useful criterion as to the existence of favourable reaction conditions. Christensen (12) of Copenhagen makes use of azotobacter in determining the lime requirement of the soil. He states that when this organism is introduced into a soil which is poor in base it disappears rapidly, in a few hours in the case of acid soils. Christensen's view is that when the organism shows no development lime is needed; when development is vigorous no lime is needed.

(e)—*Plant Diseases.**—*Finger-and-toe—Potato Scab—Tobacco Wilt.*

The prevalence of certain plant diseases is known to be intimately dependent on soil reaction. Finger-and-toe disease is much more prevalent in sour than in limed soils, but no very precise data appear to be available as regards the hydrogen-ion concentration at which this disease begins to manifest itself. On the other hand, some extremely interesting observations from this point of view have been made on the prevalence of potato scab. In 1918, Gillespie and Hurst (25) of the Maine Agricultural Station made observations on nearly fifty soil samples from scab infested districts. Some of these samples were from fields which yielded clean potatoes, while others were from diseased plots. They found that with the exception of one soil of pH 4.9, from which the potatoes were only slightly infected, no scab appears until pH 5.16 is reached. From this to pH 5.5 the scab is irregular. From pH 5.5 onward scab is present in every case. Gillespie (26) made observations on the growth of the scab organism (Actinomycetes) in culture solutions and his findings show that its growth is checked below pH 5.2. Waksman (67) in New Jersey and Quanjer and Hudig (58) in Germany confirm Gillespie's results. Wollenweber (71) pointed out that potato scab is caused not by one species of Actinomycetes but by several. Waksman showed that some of these strains showed growth even at pH 4.8, while others only begin to develop at pH 5.3-5.6.

A common remedy for combating potato scab consists in treating the soil with sulphur. Sulphur is oxidized in the soil to sulphuric acid by

* Since this paper was written, an investigation has been carried out by the author on the relation of the sugar-beet crop to soil reaction, and the results obtained indicate that the beet disease commonly known as phoma or crown-rot is, under Irish climatic conditions, practically exclusively confined to soils not less alkaline than pH 8.0.

micro-organisms. Hence the ultimate result of adding sulphur to the soil is to cause an increase in soil acidity. This, of course, is an entirely opposite effect to that produced by liming. In districts in the United States where potato scab is prevalent the soil is never limed, because experience has shown that lime increases the incidence of the disease. This is perhaps an extreme illustration of the assertion already made in this paper that a rational system of liming must take cognisance of the particular plants which it is proposed to grow on the limed soils. Most of the lime-requirement methods which have hitherto been proposed definitely set out to effect a total neutralisation of the soil. In the case of the potato there are indications that, apart from the prevalence of scab disease, a certain degree of acidity in the soil may be more conducive to good growth than complete neutrality. Lipman (45) has suggested alternately treating the soil with sulphur and with lime according to whether it is proposed to grow potatoes or legumes as succeeding crops on the same soil. A consideration of the quantities of sulphur and of lime necessary to oscillate the soil reaction in this manner would prove such a procedure to be economically impracticable. Most fertile soils are highly buffered and require relatively large quantities of acid or alkali to alter their reaction appreciably. Experimental data, from local soils, bearing on this will be forthcoming in a later paper.

Observations have been made by Arrhenius (4) in Sumatra on the relation between the prevalence of Tobacco-wilt disease and soil reaction. Of sixteen soils examined those which were more alkaline than pH 7 and which were well "buffered" were resistant to this disease, while those which were more acid than pH 7 were often devastated by it.

2. Influence of Hydrogen-ion Concentration on the Supply of Plant Nutrients. Nitrogen—Phosphorous—Available Plant-Food—Potassium—Calcium—Magnesium—Iron, etc.

A necessary consequence of the influence of acidity on the activity of the various bacteria taking part in the nitrogen transformations in the soil is that the supply of nitrogen to the plant inevitably diminishes with increasing hydrogen-ion concentration beyond a certain point. The influence of acidity on other plant nutrients cannot be said to have been studied with the same degree of precision and the extent of our knowledge in this respect is still far from satisfactory.

The fact that the solubility of plant nutrients is directly influenced by soil reaction may be inferred from the results of Hildebrand (32), the observations of Magistad (46) on the solubility of calcium and aluminium in the presence of phosphate and from the titration curves given by Line (42) for the solubility of aluminium phosphate at different hydrogen-ion concentrations. The solubility and consequent availability of soil phosphorus is complicated by many factors, among which may be mentioned the relative sizes of the soil particles containing phosphate and not less important, the relative proportions of calcium, aluminium and potassium and other ions in the soil solution. It is evident from Magistad's curves (l.c. p. 187)

that the solubility of calcium phosphate is depressed in increasingly alkaline soils, while the solubility is greatly increased on the acid side of neutrality. Aluminium phosphate, on the other hand, while somewhat soluble on the alkaline side of pH 8 is practically insoluble between pH 8 and pH 4.5. In a medium more acid than pH 4.5 the solubility of aluminium phosphate increases rapidly. The solubility of soil phosphorus at any particular reaction will depend to a very great extent on the relative proportions of aluminium and calcium in the soil solution. Hence a soil of pH 5 which is very poor in calcium will likewise probably be very poor in available phosphate because of the insolubility of aluminium phosphate at this reaction. A direct outcome of soil acidity in such a case would be phosphate starvation. While such a soil would undoubtedly give improved results from an addition of phosphatic manure, such results would tend to be merely temporary as long as unfavourable solubility conditions continued to exist in the soil. On the other hand a judicious application of lime only, would involve the continuous conversion of aluminium phosphate into the mere soluble calcium compound.

The efforts of the soil analyst to estimate the " available " plant-food in the soil have hitherto met with comparative failure. In estimating phosphorus and potassium in the soil the method formerly adopted, and still by no means entirely abandoned, consisted in digesting the soil with boiling strong acids, such as hydrochloric acid. Only in rare instances did the analytical results so obtained bear any practical relationship to the response given by the particular soil to the fertilizer concerned. More recently the plan was adopted of treating the soil with cold dilute or weak acids such as dilute nitric acid (0.1-0.01%) or 1% citric acid and even then the results were by no means uniformly satisfying. The use of weak acids was recommended and adopted on the assumption that plant-roots excrete weak acids; but no really convincing evidence has been brought forward to prove that plant roots excrete any acid other than the weakly acidic carbon dioxide. Haas (28) grew wheat seedlings in distilled water and found no change of reaction, measurements being made after removal of carbon dioxide. Meier and Halstead (49) found that acid culture solutions on which wheat is grown tended to become alkaline. Hoagland (37) found that barley grown in culture solutions caused the reaction to approach neutrality. Salter and McIlvaine (62) found a general tendency for plants grown in solution to regulate the reaction towards that most favourable to growth, which reaction in the case of wheat, for instance, appears to be in the neighbourhood of pH 6. Since relatively large quantities of acid or of alkali are necessary to alter the soil reaction to any great extent there seems good reason to believe therefore that the growing plant cannot appreciably change the soil reaction, and if this is inimical to a plentiful supply of any plant food the plant must consequently suffer.

While much work remains to be done on the relation between hydrogen-ion concentration and the availability of plant nutrients such as phosphate, it is safe to assume from the available data that such relationship exists; and in so far as this is so, it is obvious that analytical methods which radically alter the soil hydrogen-ion concentration are incapable of giving

uniformly reliable results in regard to the availability of plant nutrients. Dyer's method for the estimation of available phosphate and potash has given good results in some instances, but it fails in many others. The solvent used, which is 1% Citric acid, has a hydrogen-ion concentration of pH 2.2. As already stated, aluminium phosphate is practically completely insoluble between pH 4.5 and pH 8.0, while at reactions more acid than pH 4.5 it becomes readily soluble. It is obvious that a soil of pH 5 which is poor in calcium and which contains its phosphate in insoluble aluminium and iron compounds will be unable to yield much phosphate to the plant, while it will readily yield it to a solution of citric acid of pH 2. That under acid soil conditions phosphate appears to become less available (Compare Truog (64)) while dilute acids readily extract soil phosphorus in the laboratory do not therefore prove such contradictory facts as might at first sight appear.

In regard to potassium there is scarcely any definite evidence that the supply of this element is directly affected by acidity. The relation of potassium to the base-exchanging silicates has already been discussed and while potassium may be displaced from the base-exchanging complex by acids, there is no reason to believe that the soil pH is directly related with its availability.

It is generally held that plants require so little calcium as plant food that other than in very exceptional instances the supply of this element cannot be regarded as a limiting factor in plant growth on acid soils. It is a general experience that the application of calcium sulphate or gypsum to an acid soil provides no improvement in the symptoms of soil-sourness, although it adds calcium to the soil. In regard to the supply of calcium required by a crop there is reason to believe that different crops have vastly different needs. Truog (64) holds that certain plants require relatively large quantities of calcium carbonate as such, for the specific purpose of neutralising organic acids formed in the course of metabolism. From this point of view this author believes that the lime-requirement of the plant itself is a prior consideration to the lime-requirement of the soil. On the other hand, Robinson and his co-workers (60) find with Welsh soils that the lime-requirement can best be deduced from the amount of exchangeable or replaceable calcium which the soil contains. The considerations already brought forward, in that an acid soil which is poor in calcium will be liable to contain its phosphate in an insoluble form, may offer at least a partial explanation of these results.

McIntire, Willis and Hardy (48) noted the complete absence of magnesium from the soil water of some acid soils which they examined and since magnesium is essential to plant growth this point is of undoubted importance; but it has not been established, nor is it likely, that lack of magnesium is a limiting factor in plant growth on acid soils in general.

Soil acidity is undoubtedly favourable to a relatively high solubility of elements such as iron, aluminium, manganese, zinc, etc. The adverse effect of some of these will be referred to in the next section. Iron is the only element of the group mentioned which is essential to the plant. The solubility of iron is decreased when lime is added to the soil; not only

that, but increasing amounts of solid calcium carbonate in the soil appear to diminish the solubility of iron still further. In soils containing a very high percentage of calcium carbonate, as in the case of chalk formations, the solubility of iron may be so depressed that plants such as the apple and the lupine suffer from chlorosis through lack of iron. The addition of soluble iron compounds to the soil is of no avail in such cases since the added iron is quickly insolubilized. In the next section the toxic effects of substances of high solubility in acid soils will be dealt with.

3. Influence of Hydrogen-ion Concentration on the Solubility of Toxic Substances in the Soil.

In recent years considerable attention has been devoted to the presence of soluble aluminium in acid soils and to the toxic effect of this substance on certain plants. It has been observed that when some soils receive continuous applications of sulphate of ammonia, without lime, the soil is ultimately found to contain sulphate of aluminium.

In 1915, Ruprecht (61) of the Massachusetts Experiment Station made observations on the effects of soluble iron and aluminium salts on clover seedlings in culture solutions. He noted that concentrations as low as forty parts per million of dissolved aluminium, or ferrous iron at a concentration of four parts per million, were toxic to clover. The toxicity could to a large extent be overcome by the addition of calcium carbonate. In the same year Connor (14) concluded that aluminium salts are the prime cause of acidity in certain soils. This author noted that the toxicity could be overcome by treatment with phosphate. Abbot, Connor and Smalley (1) in studying the toxicity of aluminium in an acid peaty soil associated the presence of soluble aluminium with the process of nitrification in so far as the aluminium appeared to be present in the form of aluminium nitrate. They noted that the aluminium was precipitated by liming. Miyake (52) states that soluble aluminium is toxic to rice.

In 1918 Hartwell and Pember (31) made a special study of the question. In field experiments at Rhode Island it was observed that while liming exerted little or no influence on the growth of rye, the yields of barley were more than doubled by the treatment. By studying the action of aluminium salts on the growth of these two plants in solution cultures they noted that aluminium was relatively much more toxic to barley than to rye. They concluded therefore that the greatly increased yields of barley obtained on the limed plots were due to the precipitation by lime of aluminium salts from the soil solution. On the other hand, aluminium may readily be precipitated from solution by the addition of a soluble phosphate. Hartwell and Pember found that while certain plants, such as lettuce, were so sensitive to an acid soil that no growth was possible, yet *these same plants grew extremely well on the same soil after a heavy treatment with acid phosphate or superphosphate had been administered*, although they state *that the phosphate treatment actually increased the acidity of the soil*. They interpret these results as being an indication that the practical advantages of phosphating or of liming an acid soil may be

due as much to precipitating aluminium as to supplying phosphorus as a nutrient in the one case, or as a means of reducing soil acidity in the other.

The results of Hartwell and Pember were so striking that they have been the subject of much critical examination by other investigators. Aluminium is not, of course, one of the elements essential for plant growth, but analyses of different plants invariably reveal its presence in the ash. This is not particularly surprising when we remember that this element is extremely plentiful in practically all soils. Some observers have noted instances where aluminium has a stimulating effect on plant growth. Mazé (47), for instance, asserts that aluminium is essential to the best growth of maize. A review of the work carried out on the physiological influence of aluminium on plants in general would appear to indicate that the substance is toxic only when present in solution beyond a certain concentration. In smaller concentrations (below 0.005% ?) its action may be even that of a stimulant. (Compare Mirasol (51)).

The chief question in dispute, however, is not whether aluminium is toxic, but whether ordinary acid soils contain soluble aluminium in sufficient concentrations to completely explain soil sourness. Solutions of the sulphate, chloride or nitrate of aluminium all have an acid reaction, owing to the fact that hydrolytic dissociation gives rise to appreciable quantities of the free acid. Certain authors profess to see in this liberation of free acid from aluminium salts an entire explanation of the acidity of acid soils. It is true that simple artificial treatments of acid soils yield relatively large quantities of soluble aluminium, but it does not follow that the aluminium content revealed by such treatments bears any relation to the soluble-aluminium content of the soil in its natural condition. Burgess (11) set out to develop a method for the analysis of "active," or soluble, aluminium in acid soils and found that neither pure water nor carbonated water dissolve sufficient quantities of aluminium, even from very acid soils, for accurate quantitative estimation. He was consequently obliged to extract the soil with half-normal acetic acid, thereby imposing an exaggerated acidity. Veitch (65) was probably the first to give attention to aluminium as a cause of soil acidity. He examined the Hopkin's method for estimating lime-requirement, which involves extracting the soil with a solution of a neutral salt, such as sodium chloride, and titrating the acid which is present in the resulting extract. Veitch showed that the acidity of the extract so obtained was due to the presence of aluminium salts. If an acid soil be extracted with pure water, the extract will be found to contain extremely little titratable acid. When a solution of a neutral salt of sodium, potassium or calcium is used, base exchange takes place. It is extremely doubtful if aluminium is an exchangeable base in the commonly accepted sense of the term. What probably happens is that hydrogen ions are displaced by the base of the salt, that these combine with the liberated acid radicles of the salt, yielding the free acids and that these in turn dissolve aluminium from the soil after the manner of acetic acid as used in the Burgess method. The essential point to note is that rather than producing the acidity of the soil, the aluminium salts are themselves produced by this acidity. They consequently do not explain it.

Artificial treatments of the soil, such as those just mentioned, which serve to solubilize relatively large quantities of aluminium can throw no decisive light on the question as to whether the soil in its natural state ever contains aluminium salts in toxic concentrations. Only a direct estimation of aluminium salts in the soil solution can do so. Magistad (46) has recently made a study of the problem from this point of view and his results show a definite correlation between the hydrogen-ion concentration of the soil and the proportion of aluminium present in the soil solution. He detected a relationship so close that he found it possible to deduce the aluminium content of the soil solution from the pH of the soils which he studied. At pH 5 he found 1-2 parts per million of Al_2O_3 in solution. As the acidity decreases towards the neutral point the solubility of aluminium decreases to practically zero. When the acidity becomes greater than pH 5 the solubility of aluminium increases rapidly until pH 4.5 is reached, beyond which the solubility increases very rapidly. Magistad carried out some interesting sand culture experiments for the purpose of determining the effect of aluminium at different acidities on a number of agricultural plants. To one series of cultures he added an aluminium salt while a second series served as a control. He was thus able to compare the action of various hydrogen-ion concentrations on different plants with the action of these same hydrogen-ion concentrations superimposed on the action of soluble aluminium, the concentration of the latter being necessarily dependent on the hydrogen-ion concentration in each solution. He concluded from these studies that at acidities less than pH 5, or thereabouts, red clover, alfalfa, oats and rye showed little or no evidence of aluminium toxicity while corn, barley and soybeans suffered appreciably. At these same acidities red clover and alfalfa suffered greatly from mere acidity while barley, corn, oats and rye suffered much less, but still appreciably; soybeans suffered little or not at all from acidity. At acidities greater that pH 5, on the other hand, all the crops examined suffered greatly both from increased hydrogen-ion concentration and from the presence of aluminium.

Magistad concludes, that since most soils under agricultural conditions lie between pH 5 and pH 7, the practical benefit derived from liming in the case of clover, oats, rye and alfalfa is due to decrease in acidity and not to precipitation of dissolved aluminium. In the case of corn and barley the benefit is due both to decrease in acidity or hydrogen-ion concentration and to precipitation of aluminium; while any benefit derived from liming in the case of soybeans can only be due to precipitation of aluminium.

It is thus apparent that under practical conditions aluminium toxicity is only likely to arise in the case of very acid soils or in the case of a limited number of crops. Line (42), of Cambridge, disputes the aluminium theory of acid soil toxicity in a general way. He bases his argument mainly on the extremely low content of soluble aluminium in the soils which he examined and attributes the toxic action of aluminium in culture solutions chiefly to phosphate starvation, the phosphate being precipitated, probably out of reach of the plant roots, as aluminium phosphate. Aluminium phosphate is nearly completely precipitated at pH 5. At greater

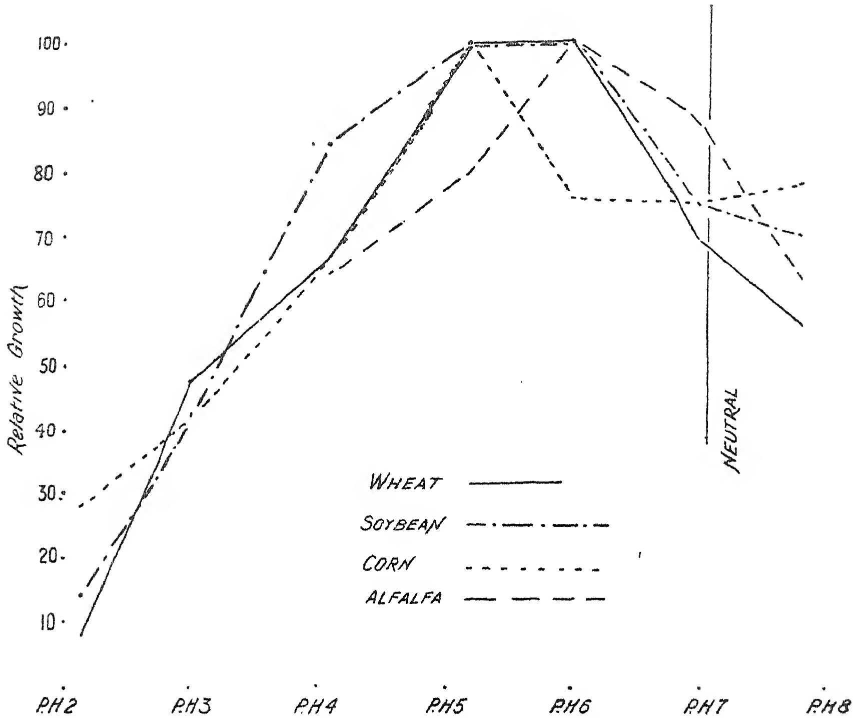


FIG I Showing relation of reaction to growth of plants mentioned.

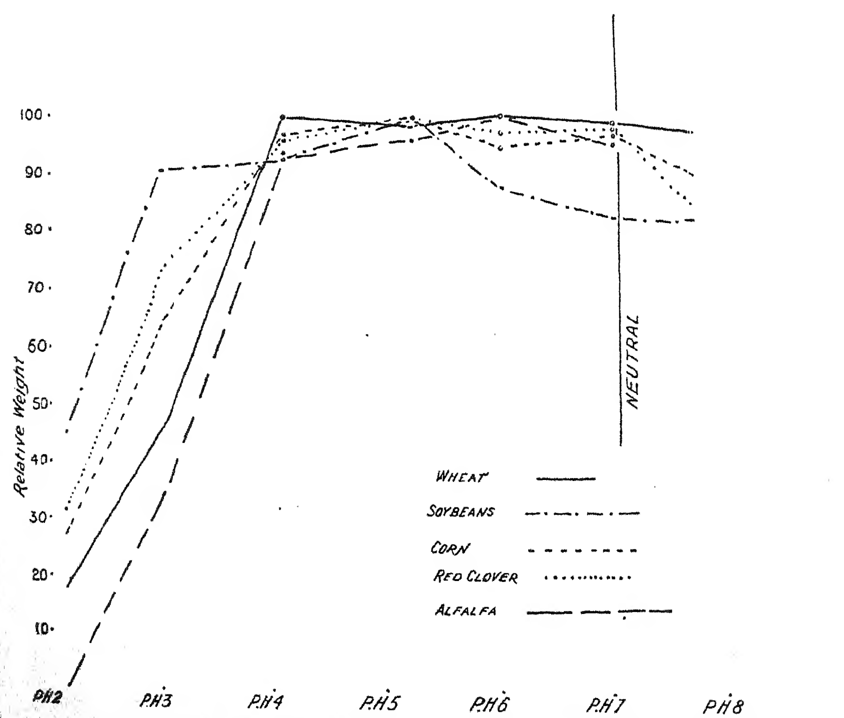


FIG II Showing relative weights of sprouts produced by Seeds of plants mentioned in 7 day Germination period.

Results of Salter and McIlvaine showing influence of hydrogen-ion concentration of culture medium on the growth of seedlings and on germination.

acidities its solubility increases, yet there is evidence that the apparent toxic action of aluminium still remains. No doubt the great insolubility of aluminium phosphate in the region of pH 5 is an important factor in phosphate nutrition in soils at this reaction.

Magistad's conclusions in regard to the benefits derived from liming must not be taken as excluding the action of lime on soil bacteria and on the availability of plant nutrients as already discussed. In this connection, likewise, it is interesting to note that Ames (2), Denison (16) and Whiting (70) have observed that nitrifying bacteria appear to be extremely sensitive to traces of soluble aluminium.

While most attention has hitherto been given to the toxicity of soluble aluminium there are other metals which likewise increase in solubility with increase in hydrogen-ion concentration. In local circumstances some of the more uncommon metals such as zinc might prove detrimental to plant growth in this way. Iron and manganese are relatively common in most soils and their concentration in the soil solution appears to be closely related to hydrogen-ion concentration. Iron is, of course, essential to plant growth, but in an acid water-logged soil its presence in the form of soluble ferrous salts might be expected to be far from beneficial. As already mentioned, Ruprecht (61) found a concentration of four parts of soluble ferrous iron per million to be toxic to clover seedlings.

4. The Direct Influence of Hydrogen-ion Concentration on Plant Growth.

From what has already been stated concerning the influence of hydrogen-ion concentration on the acidity of soil bacteria and on the availability of plant nutrients and the activity of plant toxins in the soil it will readily be understood that the question of the direct influence of hydrogen-ion concentration on the plant does not lend itself to separate study when the plant is grown in the soil. Much useful information would be gained by observations made on the growth of plants either on various soils of different acidities or on samples of the same soil, the hydrogen-ion concentrations of which have been adjusted to different values; but in such cases it would obviously be essentially difficult, in interpreting results, to disentangle the respective influences of the various soil-factors involved. By means of sand or solution cultures, on the other hand, it is possible to arrange a series of experiments in which hydrogen-ion concentration is the only variable, due allowance being made for osmotic and other influences resulting from the addition of acid or of alkali necessary to vary the hydrogen-ion concentration.

Perhaps the most instructive work on these lines hitherto carried out is that published by Salter and McIlvaine in 1920 (62). These investigators grew wheat, soybeans, corn and alfalfa seedlings in solutions of different hydrogen-ion concentrations and the relation of the growth of these plants to reaction may be seen in Figure 1.

Salter and McIlvaine also carried out germination tests on wheat, soybeans, corn, alfalfa and red clover and the relative weights of sprouts of these plants produced in a 7-day period at different hydrogen-ion concentrations are shown in Figure 2.

The most striking feature about these results is that germination, in the case of the plants studied, appears to be indifferent to acidity, as such, down to pH 4, while the subsequent growth of the seedlings was best under definitely acid conditions (from pH 5 to pH 6). At greater acidity than pH 5 it will be seen that growth rapidly diminshes.

Work on similar lines has been carried out by Hoagland (37 & 38) and by Conner and Sears (15), who found that corn grew better at pH 5 than at pH 6.5. Bryan (9) studied the effect of different reactions on the growth of oats and wheat. He found that the cereals are less sensitive to acids than to alkalis and also less sensitive to acids than are the legumes. He found that oats gave a maximum yield at pH 6 and that wheat yielded a maximum between pH 6 and pH 7. At pH 4-5, oats grew much better than did wheat. In an earlier paper, Bryan (10) notes that clover and alfalfa grow best and that maximum nodulation takes place at a neutral or slightly alkaline reaction.

It was pointed out some pages since that the various species of micro-organisms display maximum growth and activity at a particular hydrogen-ion concentration. The work just quoted is sufficient evidence to indicate that this seems likewise true of the higher plants. A knowledge of the "optimum" reactions of agricultural plants would undoubtedly be of importance since the aim in liming should be to approximate the soil to this reaction, while still keeping the soil reaction compatible with the physico-chemical conditions and bacterial processes which are essential to its highest fertility. At present all that can be said with any definiteness of the optimum reactions of agricultural plants is that leguminous crops grow best under neutral or slightly alkaline conditions, cereals grow best under slightly acid conditions, while Hudig and Meyer (39) state that a slightly acid medium is likewise necessary for the best potato culture. There is no apparent disparity between these results arrived at chiefly in laboratory cultures and general agricultural experience.

It is, perhaps, a necessary consequence of the influence of hydrogen-ion concentration on plant growth that acidity must be an important factor in plant competition under natural conditions. Atkins (5) records the hydrogen-ion concentrations of the habitats of over a hundred native plants, and shows that this measurement is a valuable index of various soil conditions, and that many plants are limited to a short range of pH values. Others, with a wider range, occur mainly in one portion of it, but some plants grow well at widely different soil reactions. Kelley (40) concludes from his observations that the hydrogen-ion concentration of the soil is an ecological factor in plant growth. He finds that the soil of a particular locality has a more or less definite pH and that plants found on this soil are frequently those having a preference for that pH. Wherry (68) and Olsen (55) likewise emphasise the importance of hydrogen-ion concentration as a very potent factor among those which determine the natural distribution of plant species. It seems likely, therefore, that in meadow or permanent pasture, hydrogen-ion concentration must exert an important influence in determining the nature of herbage. In this respect it is of interest to note that four soil samples taken from two of the most reputed

Co. Meath pastures were examined by the author and while one was found to be nearly neutral at pH 7.0, the other three were somewhat acid, two having a hydrogen-ion concentration of pH 6.5, while the fourth was at pH 6.0.

Conclusion.

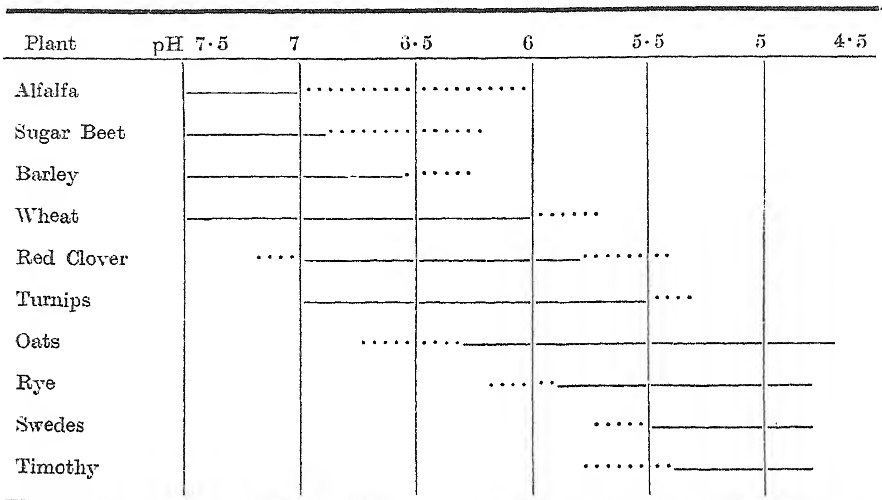
In the foregoing pages an attempt has been made to present in a general way the various factors relating to soil reaction or acidity in so far as these appear to be concerned with plant growth. If the presentation as a whole appears somewhat complex, this is due in part, at least, to the obvious complications of the problem, and this review would necessarily be incomplete without some attempt to correlate the many aspects treated of, for the purpose of drawing a practical conclusion.

While neutral or slightly alkaline soils appear to provide the best conditions for beneficial bacterial activity, and while neutrality is itself a safeguard against certain toxic conditions in the soil, it is none the less evident that most soils can undergo a considerable degree of acidification without serious diminution of bacterial activity or without the production of conditions seriously toxic to most plants. Not only may a certain degree of acidification be tolerable from either of the view-points stated, but an actual, though limited, acidity may in itself be beneficial from a nutritional standpoint. When it is recollected, besides, that plants vary very appreciably in sensitiveness to soil acidity, the notion that all crops grow best on a neutral soil must be radically revised. Practically all of the analytical methods for the determination of lime-requirement have aimed at neutralising the soil, although it need not necessarily be believed that they always attained this aim.

Secondly, it is necessary to realise that acidity in soils is not a uniform condition; it is essentially a matter of degree, of which hydrogen-ion concentration affords a measurement. It is obviously entirely ambiguous to say that any given crop will grow best on acid soil, because it is possible for a soil to be so acid that no crop will grow well on it at all. The results of Salter and McIlvaine and others show how certain plants such as wheat and oats actually grow better in culture solutions under slightly acid conditions than when the medium is neutral. Although there is considerable evidence that many crops when grown on the soil likewise produce maximum yield under slight, though definitely, acid conditions, yet this practical aspect of the question has never received the attention which it deserves.

It is evident that a more precise knowledge of the sensitiveness of different crops to soil acidity is necessary as a basis for a proper system of liming. It has already been pointed out that soil acidity or hydrogen-ion concentration, like climate, is an important factor in regulating the natural distribution of plant species. It seems equally true that it has regulated to a considerable extent the distribution of agricultural crops. In any given circumstances the farmer naturally tends to grow the crops for which he finds his soil most suited. It may be said that a neutral soil gives the farmer greatest freedom of action in the choice of crops; an acid soil will tend to restrict his choice in accordance with the extent of the acidity.

An attempt to determine the relation between the hydrogen-ion concentration of the soil and crop distribution and yields has recently been made in Sweden by Arrhenius (3). A survey was made on about 200 farms and the following table gives a general idea of the results obtained. The unbroken lines indicate frequent cultivation and good yields, while the dotted lines indicate poor yields and less common cultivation:—



This table clearly illustrates the manner in which crop distribution and soil reaction are associated in the district studied. It might be erroneous to infer from it, however, that the crops, such as oats, which give good yields and are of common occurrence on the more acid soils would not grow equally well or perhaps even better on more neutral soils. Rather would it appear that the relative absence of oats on the more neutral soils is due to the fact that the farmer grows beet and wheat on neutral soil by preference.

There are districts in Ireland where tillage is nearly entirely confined to the cultivation of potatoes and oats. A soil sample taken from one such district in Co. Fermanagh was found to have a hydrogen-ion concentration of pH 5. This soil was devoid of carbonate. While the two crops mentioned grow really well on this soil, it would be safe to predict from a consideration of acidity alone that wheat and barley would grow relatively poorly and that leguminous crops and beet would grow on it much more poorly still.*

A laboratory investigation of the soil just referred to has shown that an application of at least 12 tons of limestone per acre would be necessary to

* Since this article was compiled, the author has investigated the results of the 1928 sugar-beet crop in several Irish counties. The soils from the best crops dealt with lay between the limits pH 5.8 and pH 7.2. With the exception of cases of diseased roots which showed infection by phoma, and which occurred only on very alkaline soils, all of the crop failures examined were on soils which proved to be more acid thean pH 5.3. There is good reason to believe that on soils of this nature, any attempt to cultivate sugar-beet, without first amply liming the soil, is to be regarded as nothing better than speculation.

bring the surface soil alone to a neutral condition. On a 100 acre farm this would necessitate the crushing or burning of at least 1,200 tons of limestone. The net result of this formidable outlay would probably be to enable crops to be profitably grown on this farm which are not cultivated on it now, while the crops already grown there would not necessarily receive any appreciable benefit at all. It would obviously be more economic to continue to devote land of this nature to acid-tolerant crops using liming merely as a means to keep acidity within suitable limits which remain to be determined.

If the practice of liming is to be placed on a rational and scientific basis two lines of investigation appear to be necessary. First, it is necessary to determine definitely, in what manner, under practical agricultural conditions on a variety of soils, the yields of different agricultural crops are related to soil acidity as measured in terms of hydrogen-ion concentration. Second, it is necessary to perfect a laboratory technique to facilitate the prediction of the quantity of lime required to produce the hydrogen-ion concentration in the soil necessary to give the best results with the crops for which the soil concerned is primarily most suited. In regard to the first line of investigation, much useful information might be gained, to begin with, by an examination of the hydrogen-ion concentrations of soils already known to be most suited to various crops. A few results from good pasture land have already been referred to, but more extended observations of this nature are necessary to justify general practical conclusions. The results of a laboratory investigation dealing with the control of hydrogen-ion concentration in the soil will be presented in a later paper.

The discussion in this paper on the effects of lime on acid soils has necessarily been confined to its influence on soil reaction and to the manner in which it thereby controls many factors of importance to soil fertility. It must not be overlooked that the effect of lime on the physical texture of many soils is a factor of capital importance. There is no definite evidence that hydrogen-ion concentration and deflocculation are to any extent interrelated in ordinary soils, but there is reason to believe that in the majority of cases an application of lime sufficient to bring the hydrogen-ion concentration of the soil within limits suitable for most agricultural purposes will suffice at the same time to produce the improvement in physical condition commonly necessary in very acid soils. It is to be noted, moreover, that burnt lime, because of its caustic nature, may possibly produce immediate, though perhaps relatively temporary effects because of its disinfectant action on the soil, irrespective of its influence on reaction. Certain soils give very appreciably increased yields after treatment with disinfectants such as chloroform or carbon disulphide. The increased fertility in such cases appears to be due to partial sterilization of the soil. Soil which has been thoroughly air-dried likewise shows increased productivity from a like cause. It is theoretically possible for caustic lime to act in a similar manner, even on a soil which is already neutral or even alkaline. These aspects of the question, however, will be reserved for later investigation.

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NOTES AND MEMORANDA.

Economic Use of Stable Manure. Danish Experiments.

It is estimated that stable manure loses one-half of its valuable contents—notably nitrogen—in the process of carting and spreading, and in order to throw some light on this question, an important series of experiments—first in the laboratory and later in the field—have been carried out by the Danish agricultural experiment stations. The initial results obtained have aroused a great deal of interest among Danish farmers.

The laboratory experiments showed that, even in the course of a single day after spreading, stable manure loses from 11 to 15 per cent. of its nitrogen; in the course of 4 days, it frequently loses as much as 25 per cent.

The field experiments were carried out in 1925-26 at several different places. At Askov, the manure was spread on 12th April, 1926, in dull cloudy weather. The results obtained were as follows:—

	Yield in 100 kg. per ha. (2½ acres).	Relative figures.
Unmanured	23·7	65
Stable manure:—		
Ploughed in at once	36·7	100
,, after 6 hours	35·7	97
,, ,, 24 hours	35·3	96
,, ,, 4 days	32·3	88
Half quantity, ploughed in at once	32·7	89

Very similar results were obtained at two other experimental stations.

A comparison of the results obtained from the half-quantity of stable manure when ploughed in at once, and from the full quantity when left lying for 4 days, shows that, in 9 cases out of 15, every second load of manure might have been saved without detriment to the yield. In the 6 remaining experiments, every third or fourth load might have been saved.

The investigation showed that the question of whether manure should be applied in spring or autumn is relatively unimportant in many cases compared with the question of ploughing in from day to day. The results obtained demonstrated that a proper use of stable manure, i.e., carting and spreading in still, damp weather, and ploughing in at the earliest possible moment, will show an immediate return in the shape of a very considerable increase in yields.

Progress of Pig Breeding in Denmark.

In the course of an address to representatives of the Danish Co-operative Abattoirs, Professor A. Mörkeberg gave some interesting particulars of the government pig-breeding schemes. He mentioned at the outset that England was still their principal market, having taken no less than 98½ per

cent. of all the Danish bacon exported in 1926. The object kept steadily in view is therefore to breed pigs which will satisfy the requirements of the English market. That this object has been attained is shown by the high position taken by Danish bacon on the English market, where it fetches a higher price than any other imported bacon, with the exception of Irish.

Irish and Canadian bacon are the principal rivals to Danish, and it is to be noted that, whilst the top price obtained for Irish bacon was 9 or 10 per cent. above the top price for Danish in 1923 and 1924, it was from 11 to 16 per cent. higher per quarter in 1926; and whilst the Danish top price was 8 per cent. above the Canadian in 1924, the difference per quarter was only from 3 to 5 per cent. in 1926. This would appear to justify the assumption that the quality of Danish bacon has not risen in the same degree in the past two years as has that of Irish and Canadian bacon.

The Danish Government have organised a fine system of pig breeding, with recognised centres for Yorkshires and native Danish pigs. All that is needed is to utilise that system even more thoroughly than hitherto, and to work it to its fullest capacity. During the year 1926, these breeding centres were much handicapped by outbreaks of foot-and-mouth disease, which attacked the young stock, and interfered with sales.

During the past year, twenty local committees were at work, supervising the approved centres and dealing with applications from others seeking State recognition. There are also nine judging committees, one for each of the administrative divisions of the country. The number of centres for breeding the native Danish pig has increased from 170 to 181 during 1926. The stock of pigs increased from 247 boars and 1,247 sows to 267 boars and 1,418 sows. During the year from 1st Sept., 1925, to 31st Aug., 1926, 2,591 litters were produced, averaging 10.8 pigs at birth, and 8.2 at weaning.

The number of Yorkshire centres is 27, a reduction of three on last year's figures. The stock consisted of 42 boars and 251 sows. During the year under review, 457 litters were produced. The number of pigs per litter averaged 11.4 at birth and 8.6 at weaning. About 40 per cent. of the boars bred at these stations were sold for stud purposes, and passed into the general breeding stock of the country. There has, however, been a steady decline for some years past in the number of Yorkshire breeding centres, and several breeders have gone over entirely to the breeding of native Danish stock. Professor Mörkeberg views this development with some concern, as he holds that the Yorkshire strain is essential if Danish pigs are to be bred to the type sought for on the English market. He has studied the problem carefully and he believes that the increasing tendency to breed Danish instead of Yorkshire pigs is due to the idea, now very prevalent among Danish farmers, that the native breed is now capable of standing on its own merits alone, and that consequently a further admixture of Yorkshire blood is not necessary. If this were really so, it would no doubt simplify the work of the Danish breeder, but Professor Mörkeberg does not believe that things have really advanced so far. The sole object of the Danish breeding system is to produce better bacon, and the Yorkshire

breed undoubtedly possess qualities which make for the achievement of that end. The last big importation of stock from Yorkshire took place in 1921, and it will soon be advisable to acquire some fresh blood for the breeding centres in Denmark. About one-fourth of all the stud boars in Denmark were sent out direct from the approved breeding centres.

Bulgaria's Egg Export.

The importance of Bulgaria as an egg exporting country is on the increase. The figures for the last three years show that in 1924, 1,286 truck-loads of eggs—containing 100 cases of 1,440 eggs each—were exported. The number of truck-loads had increased to 1,525 in 1925, and to 1,630 in 1926. After being one of her best customers for eggs, Belgium has now become a rival of Bulgaria. The result is that the price of eggs on the world market has fallen. On the Franco-Swiss frontier, for example, the price of eggs per crate fell by some 25/- between October, 1925, and October, 1926. About 80 per cent. of Bulgaria's egg export goes to Germany.

Trade in Imported Butter, 1926-27.

In their thirty-third annual review of the imported Dairy Produce Trade for the year ended 30th June, 1927, Messrs. W. Weddel & Co. state that it is doubtful whether there has ever been a period so consistently unsatisfactory as the year just ended. "Starting with an overwhelming accumulation of stocks hanging over a market paralysed by the effects of the most disastrous strike in the history of this country, and continuing under an attempt by the New Zealand Control Board to maintain prices at an artificial level, the year [illegible]ged its weary way to the end in an unbroken succession of dis[illegible] for everybody concerned."

The New Ze[illegible]roduce Control Board, in spite of a good deal of oppositio[illegible] side and in the Dominion, assumed absolute control over the [illegible]f New Zealand butter and cheese as from 1st November, 1926, a[illegible]e prices at which the product was to be sold were fixed by a comm[illegible]ee in London. The intention of the Board was to stabilise the market at a level of prices satisfactory to the producers, and so avoid the violent fluctuations which had been such a common feature of the market since the war, and which had led the New Zealand farmers to suspect that traders on this side had manipulated prices in their own interest.

In theory, continues the Report, the scheme was undoubtedly attractive to people unfamiliar with conditions in this country, but in their calculations the promoters overlooked the human factor. They failed to realise, until it was too late, the psychological effect their actions were likely

to have upon the general body of buyers, whose instinct has always been deeply antagonistic to anything savouring of interference with their freedom of action. The affair simply developed into a silent struggle between the buyers on the one hand and the Control Board on the other. All speculative activity was stopped, and a policy of hand-to-mouth trading was pursued, with a distinct tendency on the part of the buyers to avoid dealing in New Zealand butter or cheese, if any other suitable kinds were available. The result was a foregone conclusion. As Messrs. Weddel remark: "Price control can only be successful if it is complete. Any attempt to control even an important section of a trade in face of strong opposition is doomed to failure. By the middle of March the Control Board were compelled to surrender, and admit that their scheme had failed." In view of the exceptionally heavy supplies of butter that arrived from Continental sources during the summer of 1927, the position for the New Zealand farmer might have been even more serious still, but that price control came to an end when it did. As things are, the New Zealand farmer derives enormous advantage from the speculative element in the British market. Time and again it has been found that speculation is the only thing which can kindle a spark of life in a dead market. Ultimately the only factor that governs a free market like that for butter and cheese is the law of supply and demand. Any other influence can only have a temporary effect.

Messrs. Weddel state that in the year under review increased quantities of butter were imported from the Argentine Republic, Denmark, Holland, Sweden, Finland, and the Baltic Provinces, but Siberia, which three years ago seemed to promise to resume shipments of pre-war volume, has proved disappointing.

Effect of certain Feeds on Flavour and Odour of Milk.

Dried beet pulp, green oats and peas, carrots, sugar beets, rape and kale are frequently used to furnish succulence in the ration of dairy cows. It has been asserted that these and simil[illegible]art undesirable flavours and odours to milk, and the United States [illegible]ry Industry have carried out some experiments with a view [illegible] accuracy of this assertion, and to ascertaining what steps m[illegible] to minimise such effects if they, in reality, exist.

The cows selected for the investigations ha[illegible]een yielding milk relatively free from abnormal flavours and odours on a basic ration of hay and grain. They varied widely in stage of lactation period. In addition to the succulent foods tested, the cows received, in proportion to the quantity of milk produced, varying quantities of a grain mixture which included bran, oats, cottonseed meal and linseed cake meal. The ration was completed by giving the cows all the alfalfa hay they would readily consume. The following results were obtained:—Dried beet pulp in quantities up to 30 pounds soaked and fed wet to cows one hour before milking produced only a slightly abnormal flavour and odour in the milk. When fed in similar quantities immediately after milking it had no effect on flavour or odour.

Green oats and peas in quantities up to 30 pounds fed to cows one hour before milking produced only a very slightly abnormal flavour and odour in the milk. When fed after milking they had no effect on either the flavour or odour.

Carrots in quantities up to 30 pounds fed to cows one hour before milking had only a slight effect on either the flavour or odour of the milk.

Sugar beets in quantities up to 30 pounds fed to cows either before or had only a slight effect on either the flavour or odour of the milk.

Rape in quantities up to 30 pounds fed to cows one hour before milking produced a decidedly abnormal flavour and odour in the milk. When fed immediately after milking it had practically no effect on either the flavour or odour.

Thousand-headed kale in quantities up to 30 pounds fed to cows one hour before milking produced a very abnormal flavour and odour in the milk. When fed immediately after milking it had practically no effect on either the flavour or the odour.

Potato Wart Disease in Belgium.

Two centres, happily still quite localised, of potato wart disease, have been discovered in Belgium, and the Belgian Department of Agriculture have warned farmers of the disastrous consequences of any spread of this terrible disease in the country. Farmers are begged to send specimens of any supposed case to the State Phytopathological Station at Gembloux, for identification. Under the terms of the Decree of 2nd September, 1922, the presence of wart disease is notifiable in Belgium.

Regulation of Finland's Egg Trade.

The Finnish parlia[illegible]e passed a Law regulating the importation and exportation [illegible] government inspection service entrusted with the control of the [illegible]e in butter and cheese are also to undertake the task of examinin[illegible] submitted for export. Such eggs must not weigh less than 50 gramm[illegible] apiece; they must be perfectly clean, and the air space must not be hig[illegible]r than 8 mm. Only eggs weighing at least 53 grammes and having an air space not higher than 4 mm. may be accepted as first-class eggs.

Strict rules have also been made with regard to the packing and the measurements of egg cases, and as to the packing materials used.

Eggs may only be exported through ports where there is a control station, and eggs intended for export must be shipped at latest 3 days after inspection in summer, and 7 days after inspection in winter.

The same law contains provisions regarding the importation of eggs. Every egg imported into Finland must be stamped to indicate the country

of origin, and cases must be similarly stamped. The inspector examines imported eggs and may refuse to pass any eggs the quality of which is unsatisfactory.

Ground Limestone for Hens. Experiments in Sweden.

Some experiments were carried out last year in Sweden for the purpose of determining whether ground limestone could be fed to hens as a substitute for broken shell. These tests showed that the general mineral requirements of laying hens may best be compared to those of dairy cows, since both these animals produce in the form of eggs and milk, respectively, food for their young while the latter are still unable to seek it for themselves. Milk and eggs in fact contain the minerals needed for the growth of the young animal. The mineral content of eggs, however, includes a considerably larger quantity of phosphorus than is found in milk, and moreover, the phosphorus in the egg occurs chiefly in the form of organic combinations of phosphates.

Earlier investigations have shown that the various kinds of poultry possess the power of changing inorganic phosphates into organic phosphoric compounds, and hence their requirements as regards this substance can be supplied by giving phosphates and bone meal. Furthermore, a portion of the lime contained in milk is, in the egg, replaced by soda, and the egg also contains more iron, silicic acid, and carbonic acid.

The hen's general requirements as regards mineral food are not satisfied by merely feeding her on grain or grain offals, but may be easily regulated by a suitable dietary of grass, or other green food, lucerne meal, bone meal, mineral phosphates, or animal refuse such as meat meal, fish meal, and the like.

For building up the shell of her egg, the hen needs also a large quantity of carbonate of lime. This need is many times in excess of the ordinary mineral requirements, and, at the height of the season, may amount to 5 or 6 grammes per hen per day. Carbonate of lime may be given in the form of grit, agricultural lime, broken shell [illegible]d limestone. The amount required depends upon the compositi[illegible]d mixtures given and the intensity of egg-laying.

Feeding experiments with the two last-me[illegible]ed materials have shown that (1) broken shell can be used as sole egg-forming material, at the rate of about 4½ grammes per bird per day. On this diet the eggs produced had well-formed shells. (2) Ground limestone is not readily taken by hens. The rate of consumption per hen and per day was 1.6 grammes in the case of small birds and 2 to 2½ grammes in that of large birds. After a certain time of feeding the hens with ground limestone only, the hens, when broken shell was offered to them, consumed during the first few days an abnormally large quantity of the shell. The formation of the egg-shell during the ground limestone period was not altogether satisfactory. The use of ground limestone alone as shell-forming material is therefore not to be recommended.

Number of Pigs in Denmark.

According to the live stock census taken in Denmark on 16th July, 1928, the stock of pigs was made up as follows. By way of comparison, the figures for 1927 and 1926 are also given.

	1928.	1927.	1926.
Board 4 months old and over ...	17,977	19,640	17,759
Sows over 4 months, in pig ...	242,832	278,520	277,955
,, ,, not in pig ...	101,136	118,244	112,726
Fat pigs over 4 months	732,163	794,526	648,134
Bonhams 2—4 months	1,255,026	1,348,049	1,055,386
Bonhams under 2 months ...	1,010,750	1,169,644	1,010,366
Totals ...	3,359,884	3,728,623	3,122,326

The figures for 1928 show a decline on those of the previous year of about 10 per cent., or about 12½ per cent. in the case of sows in pig. The number of these is scarcely sufficient to maintain the stock as it stood at the date of the census, and a further decline in numbers is probable in the near future.

Business Men's Commission on Agriculture.

President Coolidge has been presented with a copy of the findings and recommendations of the Business Men's Commission on Agriculture, which, for a year, has been investigating the agricultural situation and studying the farm economic problem with a view to proposing remedial measures.

Among the remedial measures recommended by the Commission are: gradual tariff adjustment to equalize more nearly the benefits of the protective tariff system as between agriculture and the manufacturing industry; the creation of a Federal Farm Board to assist in the stabilization of farm prices and production; a comprehensive land utilization policy to be administered through an endowed National Agricultural Foundation; a revision of State and local tax systems; strengthening of the rural banking system; revision of railroad rates on farm products and development of waterway systems.

The Commission states that it finds it impossible to support any of the legislation proposals of the type of the McNary-Haugen Bill, which was vetoed by President Coolidge, and other measures designed to raise the domestic price over the world market price by artificially restricting the supply of agricultural products in the home market.

The Commission believes, however, it is stated, that the interests of agriculture would be better served by intelligent and discriminating efforts to diminish gradually those trade restrictions and tariffs on manufactured articles which tend to reduce the foreign markets for American agricultural products.

Farmers' Troubles the same Everywhere.

"High cost of production, and the low purchasing power of farm products in terms of other commodities, a situation generally prevalent in the United States, is also true of Europe, where agriculture is fighting similar conditions." This is the view expressed by one of the Marketing Specialists of the United States Bureau of Agricultural Economics, who has returned from a 14 weeks' trip with a party of American farmers to Denmark, France, Germany, Holland, Belgium, England and Scotland. Of these countries, he said that Denmark, because of her highly developed co-operative marketing system, is in by far the best condition. Agriculture in England and Belgium, both industrial countries, is probably more handicapped than elsewhere. The visitors were much impressed with the extensive use of hothouses in the growing of fruits and vegetables in Holland; they were also greatly attracted by the fine pastures everywhere and some useful lessons in top-dressing were carried home. Systems of co-operation and organisation were studied with much interest, but it is not certain to what extent the newly-gathered ideas can be applied to American conditions. Each foreign country has had to work out its own special system, and America doubtless will have to do so too.

His final comment on the tour is as follows: "After looking over conditions in Northern Europe, it seemed to some of our farmers that in farm organisations our own country is mid-way, being a little more united and co-operative than the French and Belgians or even than the English, about the same in a general way as the Dutch, but without the single-minded willing zeal of the Danes, or the lock-step all-together unity of the Germans. English officials seem to consider our own co-operative achievements more important than we usually regard them ourselves. Probably we are too close to some of our good points of progress to see them in due proportion."

Contagious Abortion in Denmark. Recent Legislation.

The Danish Contagious Diseases of Animals Act was amended in 1920 so as to include contagious abortion amongst the notifiable diseases. Some years later the whole question was submitted for consideration to the principal veterinary organisations, which reported strongly in favour of the retention of the existing legislation. On a change of Government, however, the matter was included in the list of items earmarked for "cutting down," and the Ministry introduced a Bill to amend the Law of 1920. This Bill has now become law.

Under Article 12 of the original Act, the owner of a cow which had aborted or which might be suspected of suffering from contagious abortion, was bound to notify the fact, and a number of restrictions came into force if the tests applied by the State Serum Laboratory yielded positive results. Under the law, as it now stands, compulsory notification is abolished, but at the same time the owner is placed under more stringent obligations than before. The restrictions now come into force automatically if the existence of contagious abortion is suspected, and the onus of producing the necessary proofs to remove that suspicion lies upon the owner. Material from

aborting cows may, as heretofore, be sent for examination to the Serum Laboratory, but in future a fresh specimen of the afterbirth as well as a blood specimen must be submitted. Where only one case of abortion has occurred in a herd, and fresh specimens cannot be obtained, and also when the first test has been inconclusive, a blood sample, taken not earlier than one month after the cow aborted may be sent in to the Laboratory. A questionnaire filled up by the Veterinary Surgeon indicates the behaviour of the owner of the cattle in every case.

Whilst, as already mentioned, obligatory notification by the owner has lapsed, Art. 18 of the Act has been altered so as to empower the authorities to call an owner to account who, by violating the restrictions imposed, helps to spread the infection.

In all essentials the restrictions imposed under Art. 12 have been maintained, but the prohibition against bringing animals from an infected herd to a cattle show has been revoked, as has the rule about placing infected animals in a special part of the market. On the other hand, there is an express prohibition against the sale by auction in company with other animals of animals from infected herds.

If the opinion sought from the Serum Laboratory is required for legal purposes, this must be stated by the applicant. A fee of 10 crowns (about 11s. 1d.) is charged for each test and opinion given.

Second International Congress of Sugar Beet Growers.

This Congress, which was held in Rome in May, 1927, just before the meeting of the 13th International Agricultural Congress, was largely occupied with the question of how best to meet the grave difficulties which European beet-growers have to face in competition with the overseas production of cane sugar. The principal address was delivered by the Polish representative who called upon the Congress to use its influence to induce the sugar-producing countries of Europe to increase their import duty on sugar, and invited the associations of beet-growers in those countries to make strong representations to their Governments upon the subject. This view was supported by the delegates from Austria, Belgium, France, Hungary, Italy, Poland, Switzerland and Czecho-Slovakia.

Great Britain, whose supplies of sugar are mainly drawn from her own colonies, was not represented at the Congress, a matter of regret to many of those present. The representative of the Netherlands, also an importer of sugar from her colonies, spoke strongly against the proposed resolution. He presented a report containing a statement as to the protective tariffs imposed in the various countries per 100 kg. of imported sugar. This tariff varies considerably in different lands.

Sweden, Norway, Finland and Russia were not represented at the meeting. The German delegates were unable to support the resolution, and the Danish representative expressed the view that a proposal to impose a higher duty on sugar would not be favourably regarded in Denmark, and consequently he did not support the resolution. The latter was then altered

to some extent, but without securing the adhesion of any but the countries mentioned above.

The representatives of these latter countries then agreed to form an " International Confederation of European Beet Growers," having its centre at Bologna. A Committee of management was then appointed, composed of Signor Ugo Casalicchio, Bologna, as President, and representatives from Czecho-Slovakia, France, Poland, and Belgium. The Committee's function is to lay the desires of the Congress before the Governments concerned, and also to discover if possible the best means of meeting the competition of cane sugar.

A recent report in " L'Indépendence belge " states that the Belgian Federation of Sugar Beet Growers have passed a number of resolutions which have been submitted to the Minister of Agriculture. Among the suggestions which the Federation wish to have adopted are the following:—(1) Increase of customs duties on sugar to 100 francs per 100 kg.; (2) Reduction of consumption duties from 125 francs to 65 francs; and (3) Elaboration of an agreement between sugar beet planters and manufacturers for the export of excess sugar production.

The Danish Butter Trade, 1927.

During the year 1927 the quantity of Danish butter exported, according to a preliminary estimate, amounted to 142,825 tons, as compared with 132,502 tons in the preceding year. Of this quantity, about 70 per cent. went to Great Britain, while Germany and Switzerland took most of the remaining 30 per cent. Smaller quantities went to America and other overseas countries. While there was thus an increase in production and export, the prices obtained were on the average lower in 1927 than in 1926. The average of the Copenhagen quotation in 1927 was 301 Kr. as compared with 307 Kr. in 1926. In the years 1924 and 1925 the quotation averages were much higher, viz., 427 and 522 Kr., respectively, but in those years the Danish krone was far below parity, so that any comparison of prices with those of the following years would be misleading.

Denmark has 1,400 co-operative dairies, besides some 300 proprietary factories. About one-third of the total quantity of butter exported is handled by co-operative sale associations, one-third by private butter exporters and the remainder by large English firms who have branch offices in Denmark for the special purpose of buying up butter and other agricultural products. The Date-marking Order which came into force on 15th November, 1926, still continues. Its object is to bring Danish butter more promptly on the market, but it has considerably increased the difficulties of the export trade. The Danish butter journal, " Smörtidende," recently commented upon the system as follows: " We have frequently expressed our opinion of this reform, namely: that while it undoubtedly forces butter on the market more quickly, since exporters must ship whether the butter is sold or not, it also causes much butter to be sold at a lower price than it would have realised had it not been date-marked. The system gives foreign buyers the chance of occasionally buying the finest Danish butter below

the current price, because it is " old." We do not believe that the date-marking system is good, but since the creamery Associations and the majority of the Exporters' Associations support it and believe that it will prove to be beneficial in the long run, there is nothing to be done but wait and see."

Danish Egg Trade. Proposed Legislation.

During the past three years, the production of eggs in Denmark has showed a steady, though slight, increase. This is indicated by the export figures, which are as follows: 1925: 40 million scores; 1926: 41 million scores; and 1927: 42 million scores.

The export trade in eggs is regulated by a law passed in 1925 which brought about a considerable improvement in the weight and quality of eggs exported. The Danish Government have now decided, " in view of the efforts made in the same direction by other egg-exporting countries," that the time has come for again revising the law which governs the export trade in eggs. The 1925 law expires in April, 1928, and the Danish Minister for Agriculture has, accordingly, introduced a Bill for its renewal, with certain amendments, the effect of which will be to tighten up control in several respects.

Mr. Harald Faber, in the course of a recent address, said that the 1925 law had worked admirably for a couple of years, but now required to be strengthened to meet increasing competition on the English market, not only from other European countries, but also from overseas. Irish eggs, in particular, both from Northern Ireland and from the Free State, had greatly improved in quality, with the result that they are competing against Danish eggs to an increasing extent. " The Irish," said Mr. Faber, " have achieved this result by their legislation . . . . and I think we can learn something from the Irish."

" In Ireland," he added, " they have solved the problem of getting at the egg collector and producer, and this has, I think, been best accomplished in Northern Ireland. Both the Irish Acts make it illegal to sell dirty and unfit eggs, but in Northern Ireland the prohibition extends to stale eggs; in other words, second-grade eggs, apart of course from cold-stored or pickled eggs." The Danish trade has suffered from what are described as second-grade or " sekunda " eggs, which are marketed in large quantities in summer and autumn, and Mr. Faber believes that the proposed Amending Bill will be a distinct advance along the line followed in Northern Ireland, the object of which is to drive the " sekunda " egg off the market.

Under the terms of this new Bill, the Minister will be authorised to order that all eggs exported or imported shall be marked in a way specified by him, both on the eggs themselves and on the packing. In the case of export, the marking on the packing shall, among other things, indicate the quality and the sorting weight of the eggs, and the packing itself must conform to the requirements of the Ministry.

All egg exporters must be duly authorised by the Ministry.

When intended for re-sale or re-delivery, Danish eggs must at the time of original sale and delivery be fresh laid, unless sold or delivered under other description. Dirty or washed eggs, or eggs that have been damaged by brooding, incubation, heat or other means, must be marked "Sekunda." The Minister may order that all who buy or receive eggs for further sale or delivery shall give notice thereof to the Ministry.

Powers are given to officers of the Ministry to extract and examine larger or smaller quantities of eggs, and where the marking is found to have been inaccurate, the whole consignment may be confiscated. To cover the cost of the control system a fee is imposed on the authorised exporters in respect of all eggs exported from the country. Offences against the regulations are punishable with fines of from 20 to 200 crowns, unless punishment for the particular offence is provided under some other legislation.

Milk Recording Societies in Germany.

The movement in favour of systematic milk-recording is extending rapidly in Germany. The latest returns show that on 1st January, 1927, the number of societies had increased by 231, and the number of controlled cows by 77,012, as compared with the previous year. There are now in Germany 2,245 milk-recording societies which comprise 42,073 herds and 819,697 cows. These controlled cows represent about 8.9 per cent. of the total number of cows in the country.

Hohenzollern is the only German State in which there are as yet no milk-recording societies. In no other State has there been any reduction in the number of societies during the year, and in most cases a definite increase has been shown. The biggest increase is in the province of Hanover which has 45 new societies, while Silesia and Schleswig-Holstein each show an increase of 25.

On the whole, the movement has spread most in the north of Germany and least in the south. The percentage of cows controlled was as follows: Danzig, 27.2; E. Prussia, 24.9; Oldenburg, 20.7; Schleswig-Holstein, 18.8; Pomerania, 18.7; Mecklenburg-Strelitz, 18.0; Mecklenburg-Schwerin, 16.9; Hanover, 14.7; Brandenburg, 14.1; Lippe, 14.0; Saxony, 13.4; Anhalt, 11.6; Silesia, 11.2; Bremen, 8.8; Brunswick, 8.4; Saxony (Free State), 8.2; W. Prussia, 6.6; Waldeck, 5.6; and Westfalia, 5.1. The remaining provinces have less than 5 per cent. of their cows controlled. It should, however, be noted that many of the cows in southern Germany are used for meat production and also for draught purposes, which accounts to some extent for the lack of interest in milk-recording in those parts.

The average yield of all controlled cows in Germany was 724.4 gallons of milk, with 3.35 per cent. of fat, and 242.6 lb. weight of butter fat.

Markets for Argentine Agricultural Produce.

A report on conditions in the Argentine Republic issued by the Department of Overseas Trade notes that the supreme importance of the British market for Argentine meat was strikingly proved by the events of

1926, which made a deep impression in the Argentine on the need of increasing the purchasing power of that market by buying British goods. In that year, notwithstanding the exceptional industrial depression, record shipments of Argentine beef were absorbed by the British market, and the public demand was even transferred from frozen to the more highly-priced chilled beef, the export of which increased from 375,567 tons in 1925 to 447,840 tons in 1926. On the other hand, a serious decline took place in the imports of frozen meat to European continental markets, and no immediate recovery appears to be likely in that quarter owing to the restoration of domestic cattle stocks, to government restriction of imports in the local agrarian interest, and to unfavourable exchanges. The hope of developing a big market for Argentine beef in the United States was frustrated, first by protective tariffs and then by total prohibition, on account of the existence of foot-and-mouth disease in the Argentine. Though this prohibition was later removed, there have been no appreciable shipments of meat to the United States.

The sheep-rearing industry in the Argentine has proved to be not unprofitable in recent years, and the prospects of the pig industry are considered to be extremely promising. The embargo on the importation of fresh pork from the continent in 1926 gave a fillip to the exportation of frozen pork from the Argentine, but full advantage cannot be taken of this opportunity until the quality of the pork is more suitable. Considerable progress has already been made in this direction, and with a soil and climate well suited to the industry, and facilities for the cheap cultivation of maize, it is thought that pig-breeding will make rapid strides if it suits the meat-freezing companies to foster it.

The butter industry continues to progress; some 30,000 tons are exported annually, practically all to the English market. Efforts are being made to organise the trade on lines similar to those followed in New Zealand.

Argentina exports fresh eggs from the middle of August to the end of November, and imports them from the middle of August to the end of June. The exported eggs go almost entirely to the United Kingdom, and totalled 1,475,124 dozens in 1926. On the other hand, some shipments of eggs were made from Northern Ireland to the Argentine, and these eggs were reported to be superior in packing, quality and size to those shipped from the United States.

Finnish Butter and Cheese Control.

Two Ministerial Orders dated 29th December, 1927, have been issued in Finland in connection with the Law of 1st July, 1927, which relates to the control of the export trade in butter and cheese. These Orders contain regulations for carrying the Law into operation.

Finland's foreign trade in butter and cheese is placed under the State Butter Control Service, which operates at specified frontier control stations through which exportation is permitted. Only products provided with the "quality brand" may be exported, though a few exceptions may be

allowed under certain conditions. The Butter Control hold quality judgings every week, and tests as to keeping quality are also made.

From every creamery's consignment, as many kegs are tested and judged as are necessary in order to decide whether the quality and character of the consignment render it suitable for exportation. In the case of large cheeses, such as Emmenthal, each cheese is examined separately, whilst of others at least 5 per cent. of every consignmnt must be examined.

All butter intended for exportation must be provided with a "label of origin," which, in addition to the words, "Pure Finnish Butter—under Government Control," bears the number of the creamery. It is the duty of each creamery to provide their butter with this label. The kegs which are taken out for examination as to keeping quality are at once subjected to a quality test, and this is repeated after the sample has been kept for 14 days at a temperature of from 6° to 10° Cel. At all these judgings, points are awarded to the butter, and in order to secure the right to use the quality brand, butter must earn a certain number of points, besides having normal keeping qualities, and must fulfil the following conditions: it must be unadulterated Finnish butter, it must be provided with the label of origin of the creamery, it must have been made of milk which has been pasteurised at a temperature of at least 80° Cel., it must contain not more than 16 per cent. moisture and at least 80 per cent. of fat, it must be free of all preservatives or aniline dyes, it must be properly packed, and there must be no mould either on the butter itself or on the packing.

Nevertheless, butter containing from 16 to 18 per cent. of moisture may receive the quality brand, provided it fulfils the other conditions, and a guarantee is given that it is being exported to countries where the above-mentioned moisture content is permissible.

In order to win the quality mark, butter must also be packed in kegs holding 50.8 kg. (111.76 lb.) of butter. This rule does not, however, come into force until 1st January, 1929.

Butter which in other respects fulfils the conditions laid down for export butter, but which has not received the quality brand owing to its not having received a sufficient number of points, may for the present be exported after it has received what is known as the "loading brand."

The regulations regarding butter, with the exception of those relating to packing and kegs, came into force on 1st January, 1928.

Danish Creamery Statistics, 1926.

The 30th Annual Report on Danish dairying statistics contains accounts from 841 creameries for the year 1926. The report shows that the average number of members per creamery has risen from 141 to 142, not a large increase in view of the constant sub-division of farms which is taking place in Denmark. The average milk yield per cow has risen from 626 gallons in 1925 to 638 gallons in 1926, an increase of about 2 per cent. On the basis of this figure, the total production of milk in Denmark in 1926 is estimated to have been something like 4.2 million tons. The average amount of milk supplied per creamery was 2.8 million kg. About 97 per cent.

of this was used for butter-making, the rest was made into cheese or sold retail.

The method adopted in paying suppliers for their milk varies considerably in different creameries. The following table shows the percentage of creameries which have adopted each of the principal methods in use:—

Year.	*Factor 2 and 3.	Cream Units.	Fat Units.	Quality.
1922	14	73	11	—
1923	10	71	17	18
1924	8	67	23	28
1925	6	61	31	32
1926	5	54	40	39

Milk-cooling machinery is being increasingly introduced; 78 per cent. of all creameries have now an installation of the kind. Working expenses fell by about 10 per cent. since the previous year; the decrease showed itself chiefly in wages, and in cost of fuel and upkeep of buildings and material. In this connection, the size of the creamery is all important; the largest establishments show the lowest working cost per 1,000 kilos of milk handled.

The amount of milk required to make 1 kilo of butter averaged 24.3 kilos, the lowest figure yet recorded. The average price of butter was 33 per cent.

*The method of payment for milk (proportionally to its fat content), known as "Differential Reckoning by Factor 2," resulted from experiments made by Fjord, the well-known Danish pioneer in scientific agriculture. The method is based on a bi-weekly test of each supplier's milk with an instrument devised by Fjord and used in his experiments. The cream samples taken do not give the butter value of the milk by direct measurement, but by differential calculation. The principle followed is to calculate the average cream percentage for the milk supplied weekly to the creamery. The difference between the average cream percentage and the cream percentage of the individual supplier's milk is the basis of difference in the payment. As the experiments showed, a difference of 1 per cent. cream corresponded to a difference of 2.4 Kvints (1 Kvint=5 grammes) of butter per can (1 can = 1.9 litres), when the tests were conducted according to the procedure laid down in the experiments. The figure 2.4 was rounded off to 2 in the tables supplied to the creameries, i.e., 2 Kvints, or 10 grammes of butter to each difference of 1 per cent. cream between the average cream percentage and the cream percentage of the milk from the individual supplier.

The "Factor 3" method of payment is also a system of differential reckoning It was adopted by certain creameries in Denmark when the instrument known as the lactoscope came into use. Experiments made with that instrument showed that samples did not stand in the same relation to each other or to the average cream percentage as when tested with Fjord's apparatus. A difference of 1 per cent. cream between two cream percentages was found to correspond to a difference of 3.2 Kvints of butter per can. The cause of this is that the cream column in the test tube controlled by the lactoscope contains less skim milk per cent. than the cream column in Fjord's apparatus, and hence it would be incorrect to take the lactoscope samples as the basis for a payment in accordance with the Factor 2 Method. In the tables supplied to milk producers the difference in the payment per can of milk was fixed as the money value of 3 Kvints of butter for each difference of 1 per cent. between the average cream percentage and the cream percentage of the individual supplier's milk. In other respects, the Factor 3 Method is the same as the Factor 2 Method.

The older methods of payment for milk—Factor 2, Factor 3, and Cream Units—are tending, in Denmark, to disappear in favour of the method of reckoning by fat units.

lower than it was last year; 13 per cent. of this decline was due to the rising value of the Danish crown.

The Dairying Industry of Australia.

The drought of 1914-15 severely depleted the dairy herds of Australia, and the number fell to 1,684,393, as compared with over 2 millions in the year 1910. In recent years, however, there has been a fairly steady increase in the numbers of dairy cattle, which reached the total of 2,444,637 in 1924.

The average yield of milk per cow varies greatly with breed, locality and season, reaching as high as 1,000 gallons, but averaging for all dairy cows in Australia 314 gallons in 1920, 343 in 1921, 288 in 1922, 285 in 1923 and 363 in 1924. The 1924 figure constituted a record. The highest averages were obtained in those States which have developed most extensively scientific methods of dairying, breeding, milk-recording and culling. In the last four years for which details of milk yield are available, Victoria has shown the highest averages, closely followed in most years by New South Wales.

Though production is affected by the nature of the season, it is clear that there has been an important advance in the level of production generally in recent years. For instance, the average annual production of butter increased from 197,000,000 lbs. in the five years 1910-14 to 250,000,000 lbs. for the years 1920-24.

A good deal of attention has been paid latterly to the question of securing uniformity of quality for the export trade and regularity of deliveries, and conditions generally may be said to be improving. It is held, however, that the lot of the dairy farmer is not a very happy one, and that if his work, and the work of his family, were entered in his books at ruling rates of wages, there would be many dairy farms which would not show adequate profits on capital invested. Still, it has been clearly shown that with scientific methods returns can be much improved, and it is not unlikely that rapid development will continue in the industry, and that dairy products in the future will form a much more important item in Australian production than they are even to-day.

Marketing of Swedish Eggs.

The Committee appointed in Sweden to study the egg trade have put forward a proposal to introduce a uniform brand for Swedish eggs intended for exportation. By laying down certain conditions as to the quality, sorting, packing, etc., for the right to use this brand, it is hoped to improve the quality of Swedish export eggs, whilst the special marking, in addition to being a quality mark, will also help to make the Swedish egg known and esteemed in egg importing countries. It is suggested that the Rune Brand, as now used for Swedish butter, should be stamped upon the packing, together with particulars as to the quality and sorting weight of the eggs. The proposal is that only eggs bearing that brand should be admitted to export. Such eggs will be graded in classes: "Swedish new-laid eggs," "Swedish cold store eggs," and "Swedish preserved eggs."

The German Margarine Industry.

The development of the margarine industry in Germany is shown by the following table, which sets forth the number of factories which were at work at different dates since the year 1874:

1874	... ...	One small margarine factory in Frankfort on Main.		
1885	... ...	55	factories with	1,000 workers.
1895	... ...	95	,, ,,	2,000 ,,
1913	... ...	145	,, ,,	14,000 ,,
1915	... ...	95	,, ,,	8,000 ,,
1917	... ...	60	,, ,,	4,000 ,,
1918	... ...	35	,, ,,	2,700 ,,
1925	... ...	180	,, ,,	28,000 ,,
1926	... ...	170	,, ,,	32,000 ,,

The output of margarine at these factories requires daily 1,200,000 kilos of fat, 500,000 litres of milk and 2,000,000 eggs, and the total production of margarine has increased from 276,000 tons in 1913 to 436,800 tons in 1926. The annual consumption of margarine in 1924 per head of the population was 20.7 kg. in Denmark, 15 in Holland, 8.5 in England, and 6 in Germany.

Poland as an Exporter of Butter.

The Polish Government have framed regulations for standardising butter consigned for exports. Such butter must be made from pasteurised cream and, if unsalted, must contain not more than 16 per cent. and if salted, not more than 12 per cent. of moisture. The fat content of unsalted butter shall be not less than 83 per cent. and of salted butter, not less than 84 per cent. The salt content of unsalted butter may not exceed 0.15 per cent. and of salted butter 0.75 per cent. Butter intended for export must be of good texture and consistency, be of a golden yellow colour, and have a delicate, nutty, fresh flavour. Instructions as to packing, transport and loading have also been issued. Standardisation, above all things, is aimed at, with a view to securing fuller recognition on foreign markets. Poland, as an agricultural country, is anxious to compete with Denmark, Lithuania, and other butter exporting countries. In the last three years, her butter export has been as follows:—

1924-25	...	155 tons.
1925-26	...	2,884 ,,
1926-27	...	6,785 ,,

In the last-mentioned year, the butter exported from Poland was distributed as follows:—Germany, 73.9 per cent.; Austria, 11.9 per cent.; England, 10.4 per cent., and other countries, 3.8 per cent. There seems to be every prospect of considerable further development in Poland's export butter trade in view of the efforts at standardisation mentioned above, and also of the steps which have been taken to increase the numbers of live stock in that country.

TABLES SHOWING THE EXPORTS

TABLE

Return of the Number of Animals Exported from Ireland to 31st December, 1928, showing the Ports

Ports in Ireland.	Cattle. Fat.	Cattle. Stores	Cattle. Milch Cows.	Cattle. Spring-ers.	Cattle. Calves.	Cattle. Total.	Sheep. Fat.	Sheep. Stores.	Sheep. Lambs.	Sheep. Total.
Irish Free State Ports:—										
Ballina ...	712	24	—	1	—	737	4,451	—	7,617	12,068
Cork	9,853	54,598	1,564	4,877	21,017	91,909	4,250	920	11,746	16,916
Drogheda ...	19,837	71	2	15	9	19,934	8,405	—	38,325	46,730
Dublin... ...	211,565	126,547	32,604	1,469	5,984	378,169	164,281	96	204,095	368,472
Dundalk ...	8,137	2,683	1	39	—	10,860	11,351	—	13,335	24,686
Galway ...	214	291	—	—	1	506	2,636	—	5,378	8,014
Greenore ...	1,812	37,302	1,555	1,161	—	41,830	6,408	—	17,259	23,667
Limerick ...	681	8,461	—	1	17	9,160	13	—	18	31
Rosslare ...	—	—	—	—	—	—	—	—	—	—
Sligo	639	1,974	7	16	173	2,809	528	—	13,511	14,039
Waterford ...	31,385	33,411	221	1,560	9,989	76,566	18,393	—	18,103	36,496
Westport ...	245	—	—	—	—	245	—	—	—	—
Wexford ...	2,044	—	—	—	—	2,044	343	—	5,177	5,520
Total ...	287,124	265,362	35,954	9,139	37,190	634,769	221,059	1,016	334,564	556,639
Northern Ireland Ports:—										
Belfast ...	23,769	70,524	13,754	3,430	—	111,477	26,638	40	41,005	67,683
Larne	106	33,503	37	673	1,197	35,516	—	278	19	297
Londonderry ...	8,643	50,171	981	1,314	10,891	72,000	15,174	1,889	17,768	34,831
Newry ...	1,165	465	21	21	—	1,672	3,592	—	7,706	11,298
Total ...	33,683	154,663	14,793	5,438	12,088	220,665	45,404	2,207	66,498	114,109
All Irish Ports:—										
Total ...	320,807	420,025	50,747	14,577	49,278	855,434	[illegible]	3,223	401,062	670,748

TABLE

Return of the Number of Animals Exported from Ireland to 31st December, 1928, showing the Ports of Debarkation

Ports in Great Britain and the Isle of Man.	Cattle. Fat.	Cattle. Stores.	Cattle. Milch Cows.	Cattle. Spring-ers.	Cattle. Calves.	Cattle. Total.	Sheep. Fat.	Sheep. Stores.	Sheep. Lambs.	Sheep. Total.
England.										
Bristol ...	338	8,848	52	445	3,447	13,130	1,134	—	357	1,491
Fishguard ...	4,700	48,046	1,672	5,687	18,145	78,250	4,743	625	2,809	8,177
Fleetwood ...	2,561	831	572	27	—	3,991	2,075	—	309	2,384
Heysham ...	8,000	29,576	9,294	1,701	47	48,618	23,185	1,717	43,794	68,696
Holyhead ...	55,415	68,214	20,300	1,940	1,009	146,878	75,502	85	83,862	159,449
Liverpool ...	173,073	61,062	6,552	862	6,702	248,251	129,824	251	233,895	363,970
London ...	—	—	—	—	—	—	—	—	—	—
Manchester ...	23,952	15	40	3	1	24,011	16,925	—	10,593	27,518
Newhaven ...	—	—	—	—	—	—	—	—	—	—
Plymouth ...	—	—	—	—	—	—	—	—	—	—
Preston ...	14,453	820	4,046	80	—	19,399	11,996	—	19,410	31,406
Silloth ...	496	9,513	97	12	92	10,210	—	—	—	—
Southampton ...	—	—	—	—	—	—	—	—	—	—
Scotland.										
Ardrossan ...	—	—	—	—	—	—	—	—	—	—
Ayr ...	1,805	30,392	176	285	—	32,658	5	—	204	209
Glasgow ...	34,592	97,565	7,475	2,859	17,440	159,931	1,023	44	5,593	6,660
Greenock ...	589	36,834	428	105	1,175	39,131	51	212	236	499
Stranraer ...	9	27,966	26	531	1,197	29,729	—	278	—	278
Isle of Man.										
Douglas ...	824	343	17	40	23	1,247	—	11	—	11
Total ...	320,807	420,025	50,747	14,577	49,278	855,434	266,463	3,223	401,062	670,748

AND IMPORTS OF ANIMALS.

I.

GREAT BRITAIN and the ISLE OF MAN during the Year ended
OF EMBARKATION IN IRELAND.

Pigs. Fat.	Pigs. Stores.	Pigs. Total.	Goats.	Horses. Stallions.	Horses. Mares.	Horses. Geldings.	Horses. Total.	Mules or Jennets.	Asses.	Total Animals.	PORTS IN IRELAND.
											Irish Free State Ports.
3,829	—	3,829	—	—	—	1	1	—	—	16,635	Ballina.
96,997	—	96,997	—	5	235	362	602	—	5	206,429	Cork.
353	—	353	1	—	—	—	—	—	—	67,018	Drogheda.
88,690	64	88,754	29	419	1,717	1,511	3,647	—	19	839,090	Dublin
685	—	685	235	—	13	4	17	—	—	36,483	Dundalk.
567	—	567	—	—	—	—	—	—	—	9,087	Galway.
13,388	—	13,388	6	—	806	873	1,679	—	7	80,577	Greenore.
165	—	165	—	—	7	3	10	—	—	9,366	Limerick.
—	—	—	—	31	26	1	58	—	—	58	Rosslare.
15,537	—	15,537	5	—	—	—	—	—	—	32,390	Sligo.
60,490	—	60,490	—	3	729	728	1,460	—	1	175,013	Waterford.
—	—	—	—	—	—	—	—	—	—	245	Westport.
129	—	129	1	—	—	—	—	—	—	7,694	Wexford.
280,830	64	280,894	277	458	3,533	3,483	7,474	—	32	1,480,085	TOTAL.
											Northern Ireland Ports.
5,315	109	5,424	1	18	716	1,422	2,156	15	52	186,808	Belfast.
770	1,288	2,058	5	3	15	44	62	—	5	37,943	Larne.
6,191	31	6,222	2	1	27	30	58	—	7	113,120	Londonderry
249	—	249	8	—	30	15	45	—	1	13,273	Newry.
12,525	1,428	13,953	16	22	788	1,511	2,321	15	65	351,144	Total.
											All Irish Ports.
293,355	1,492	294,847	293	480	4,321	4,994	9,795	15	97	1,831,229	Total.

II.

GREAT BRITAIN and the ISLE OF MAN during the Year ended
in GREAT BRITAIN and the ISLE OF MAN.

Pigs. Fat.	Pigs. Stores.	Pigs. Total.	Goats.	Horses. Stallions.	Horses. Mares.	Horses. Geldings.	Horses. Total.	Mules or Jennets.	Asses.	Total Animals	PORTS IN GREAT BRITAIN AND THE ISLE OF MAN.
											England.
2,182	—	2,182	—	—	19	23	42	—	—	16,845	Bristol.
135,238	—	135,238	—	39	934	995	1,968	—	5	223,638	Fishguard.
398	23	421	—	4	53	116	173	8	3	6,980	Fleetwood.
7,105	26	7,131	—	4	453	665	1,122	7	37	125,611	Heysham.
94,348	64	94,412	12	384	2,424	2,135	4,943	—	21	405,715	Holyhead.
46,723	—	46,723	269	23	168	212	403	—	2	659,618	Liverpool.
—	—	—	—	8	7	25	40	—	—	40	London.
7	—	7	2	1	—	1	2	—	—	51,540	Manchester.
—	—	—	—	—	6	2	8	—	—	8	Newhaven
—	—	—	—	—	2	4	6	—	—	6	Plymouth.
—	—	—	3	—	—	—	—	—	—	50,808	Preston.
376	—	376	—	1	13	16	30	—	1	10,617	Silloth.
—	—	—	—	—	2	3	5	—	1	6	Southampton.
											Scotland.
—	—	—	—	—	75	255	330	—	1	331	Ardrossan.
212	55	267	—	—	3	35	38	—	—	33,172	Ayr.
6,087	16	6,103	—	9	115	414	538	—	7	173,239	Glasgow.
—	20	20	2	4	1	11	16	—	2	39,670	Greenock.
679	1,288	1,967	5	3	15	44	62	—	5	32,046	Stranraer.
											Isle o Man.
—	—	—	—	—	31	38	69	—	12	1,339	Douglas.
293,355	1,492	294,847	293	480	4,321	4,994	9,795	15	97	1,831,229	TOTAL.

IMPORTS OF ANIMALS INTO IRELAND FROM GREAT BRITAIN AND THE ISLE OF MAN.

The number of Animals Imported into Ireland from Great Britain and the Isle of Man during the Twelve Months ended 31st December, 1928, was as follows :—

Cattle ...	... 374	Stores. 22 Milch Cows. 11 Springers. 42 Calves.
Sheep ...	... 7,956	Stores. 20 Lambs.
Pigs ...	... 68	Stores.
Goats ...	... 4	
Horses ...	... 413	Stallions. 2,448 Mares. 985 Geldings.
Mules or Jennets	2	
Asses ...	... 2	

RETURN of the Number of Horses Exported from Ireland through Great Britain to the Colonies and Foreign Countries during the Twelve Months ended 31st December, 1928, showing the Ports of Embarkation in Ireland :—

PORTS.	Twelve months ended 31st December, 1928.			
	Stallions.	Mares.	Geldings.	Total.
Belfast	—	81	171	252
Cork	—	13	52	65
Dublin	20	397	396	813
Dundalk	—	4	1	5
Greenore	—	281	189	470
Waterford	—	443	347	790
Total	20	1,219	1,156	2,395

There were 287 Goats, 1 Stallion, 1,102 Mares, 996 Geldings, 3 Jennets, and 222 Asses exported from Dublin (direct) to Antwerp, and 1 Mare from Dublin (direct) to Oslo.

IMPORTS of Horses into Ireland from the Colonies and Foreign Countries, either direct or through Great Britain, during the Twelve Months ended 31st December, 1928.

Name of Foreign or Colonial Port at which embarked.	Twelve months ended 31st December, 1928.			
	Stallions.	Mares.	Geldings.	Total.
Boulogne via Folkestone for Dublin	3	19	5	27
Boulogne (direct) for Dublin ...	—	—	6	6
Antwerp (direct) for Dublin ...	—	2	4	6
Colombo via Liverpool for Dublin ...	—	1	—	1
Bombay via Liverpool for Dublin ...	—	1	—	1
Montevideo via Liverpool for Waterford	—	—	2	2
Total	3	23	17	43

STATISTICAL TABLES.

Quarterly Average Prices for each Province, and for Ireland, of Crops, Live Stock, Meat, Provisions, &c., for the Quarter ended 31st December, 1927.

Product.		Leinster	Munster	Ulster	Connacht	Ireland
Crops—		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wheat ...	per 112 lb.	0 10 8	0 9 10	—	—	0 10 7
Oats (White ...	,,	0 8 2	0 7 9	0 7 11	0 7 4	0 7 10
,, (Black) ...	,,	0 7 2	0 6 11	—	—	0 7 0
Barley	,,	0 9 7	0 8 3	—	—	0 9 4
Potatoes ...	,,	0 5 3	0 3 11	0 3 5	0 3 1	0 3 11
Hay (1st & 2nd Years' Crop),	ton	4 4 0	3 7 9	3 9 6	3 2 3	3 12 0
,, (Meadow)	,,	3 0 6	2 4 6	2 13 3	2 3 9	2 15 3
Grass Seed—						
Perennial	per 112 lb.	—	—	1 1 3	—	1 1 3
Italian	,,	—	—	1 1 7	—	1 1 7
Flax ...	per 14 lb.	—	—	0 15 2	—	0 15 2
Live Stock—						
Calves, under 6 months	per head	3 12 6	2 18 0	2 14 0	3 14 0	3 4 9
Store Cattle—						
6 to 12 months ...	,,	7 4 6	6 9 0	7 12 9	7 6 3	7 0 3
1 to 2 years ...	,,	11 11 0	10 11 0	11 8 9	10 16 0	11 0 0
2 to 3 years ...	,,	14 17 9	13 14 3	14 12 6	14 8 3	14 7 3
3 years and over ...	,,	16 11 9	15 15 9	15 19 9	16 19 9	16 8 0
Fat Cattle—						
Under 2 years ...	,,	16 0 0*b*	13 12 3*c*	—	—	13 15 9
2 to 3 years ...	,,	17 14 0	16 10 9	17 15 0	17 13 0	17 6 9
3 years and over ...	,,	19 7 6	18 3 3	20 1 0	19 10 3	19 2 0
Cows and Bulls ...	,,	13 15 9	11 15 3	14 5 3	16 0 0	12 6 9
Springers (Cows and Heifers)	,,	20 5 9	18 8 0	21 6 3	19 4 3	20 6 6
Milch Cows (down Calved)	,,	18 7 9	18 1 3	18 18 0	17 10 0	18 10 9
Lambs, under 12 months	,,	1 18 0	1 19 0	2 2 0	1 16 0	1 18 0
Store Sheep—						
1 to 2 years ...	,,	2 7 6	2 8 9	2 9 6	2 6 0	2 7 3
2 years and over	,,	2 2 6*d*	1 4 6*e*	2 11 0	2 12 3	2 3 9
Fat Sheep—						
1 to 2 years ...	,,	2 13 9	2 19 0	2 17 0	3 7 0	2 18 0
2 years and over ...	,,	2 15 0	3 0 6	2 12 3	2 19 0	2 17 0
Young Pigs, under 12 weeks	,,	0 18 6	1 4 9	1 10 0	1 15 0	1 5 3
Store Pigs—						
12 weeks to 4 months	,,	1 9 6	1 12 3	1 14 0	—	1 11 0
4 months and over	,,	2 0 6	2 9 0	—	—	2 7 0
Fat Pigs (other than Sows)	,,	4 14 6	4 11 3	—	—	4 13 0
Fat Sows	,,	—	—	—	—	—
Sows for Breeding ...	,,	—	—	6 10 6	—	6 10 6
Meat, Provisions, &c.—		s. d.	s. d.	s. d.	s. d.	s. d.
(*a*) Beef (Live)	per 112 lb.	37 6	—	—	—	—
,, (Dead) ...	,,	65 9	—	—	—	—
(*a*) Mutton (Live)	,,	44 6	—	—	—	—
,, (Dead)	,,	78 0	—	—	—	—
Pork (Dead) ...	,,	66 9	59 3	58 3	58 3	60 0
Eggs ...	per 120	21 3	21 1	22 8	19 5	21 6
Wool	per lb.	1 1¼	—	—	—	1 1¼

(*a*) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(*b*) First class, 10 animals. (*c*) Second class, 129 animals. (*d*) Some Mountain Type. (*e*) All Mountain Type.

STATISTICAL TABLES.

QUARTERLY AVERAGE PRICES FOR EACH PROVINCE, AND FOR IRELAND, OF CROPS, LIVE STOCK, MEAT, PROVISIONS, &c., for the Quarter ended 31st March, 1928.

PRODUCT.		Leinster	Munster	Ulster	Connacht	Ireland
Crops—		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wheat ...	per 112 lb.	0 11 1	—	—	—	0 11 1
Oats (White) ...	,,	0 9 10	0 9 0	0 9 3	0 7 11	0 9 1
,, (Black) ...	,,	0 8 10	0 7 11	—	—	0 8 9
Barley	,,	0 9 5	—	—	—	0 9 5
Potatoes	,,	0 5 4	0 4 1	0 4 0	0 3 5	0 4 4
Hay (1st & 2nd Years' Crop),	ton	4 13 6	3 16 9	3 11 3	3 12 9	3 18 9
,, (Meadow) ...	,,	3 8 0	2 9 0	2 16 0	2 12 9	3 1 9
Grass Seed—						
Perennial	per 112 lb.	—	—	0 18 10	—	0 18 10
Italian ...	,,	—	—	1 0 11	—	1 0 11
Flax ...	per 14 lb.	—	—	0 15 10	—	0 15 10
Live Stock—	per					
Calves, under 6 months	head	3 10 9	3 0 0	2 19 6	3 14 9	3 5 3
Store Cattle—						
6 to 12 months ...	,,	7 11 9	7 1 0	7 13 3	7 13 9	7 7 9
1 to 2 years ...	,,	12 2 0	11 4 9	11 12 9	11 16 9	11 12 3
2 to 3 years ...	,,	15 3 9	14 7 6	14 7 6	14 17 6	14 15 3
3 years and over ...	,,	17 6 9	15 6 9	13 4 3	17 12 6	16 16 9
Fat Cattle—						
Under 2 years ...	,,	17 2 6(b)	14 18 0(c)	—	—	15 19 0
2 to 3 years ...	,,	18 18 9	17 9 9	18 19 0	18 0 3	18 7 3
3 years and over ...	,,	20 17 3	19 13 0	—	20 16 6	20 11 6
Cows and Bulls ...	,,	17 9 9	13 13 9	16 6 3	18 13 3	14 16 9
Springers (Cows and Heifers)	,,	19 10 9	17 13 9	20 0 3	19 2 0	19 0 6
Milch Cows (down Calved)	,,	18 0 3	16 13 3	17 8 9	17 5 3	17 10 9
Lambs, under 12 months	,,	2 4 3	2 11 3	2 12 6	2 8 0	2 8 3
Store Sheep—						
1 to 2 years ...	,,	2 6 9	2 18 6	—	2 12 3	2 13 0
2 years and over	,,	2 7 3	—	—	—	2 7 3
Fat Sheep—						
1 to 2 years ...	,,	3 6 3	3 11 0	2 18 6	3 14 0	3 9 0
2 years and over ...	,,	3 3 9	3 16 6	3 1 3	3 17 6	3 8 6
Young Pigs, under 12 weeks	,,	1 0 3	1 6 0	1 12 0	1 17 6	1 7 0
Store Pigs.—						
12 weeks to 4 months	,,	1 14 3	1 16 0	—	—	1 15 3
4 months and over	,,	2 5 0	2 9 3	—	—	2 8 3
Fat Pigs (other than Sows)	,,	4 4 0	5 5 0	—	—	4 13 0
Fat Sows	,,	—	—	—	—	—
Sows for Breeding ...	,,	—	—	9 12 9	—	9 12 9
Meat, Provisions, &c.—		s. d.	s. d.	s. d.	s. d.	s. d.
(a) Beef (Live)	per 112 lb.	44 9	—	—	—	—
,, (Dead) ...	,,	78 3	—	—	—	—
(a) Mutton (Live) ...	,,	60 6	—	—	—	—
,, (Dead) ...	,,	106 0	—	—	—	—
Pork (Dead) ...	,,	74 9	69 6	75 3	67 3	71 0
Eggs	per 120	12 11	12 7	13 3	12 5	12 11
Wool	per lb.	—	—	—	—	—

(a) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(b) First class, 25 animals. (c) Second class, 29 animals.

QUARTERLY AVERAGE PRICES FOR EACH PROVINCE, AND FOR IRELAND, OF CROPS, LIVE STOCK, MEAT, PROVISIONS, &c., for the Quarter ended 30th June, 1928.

PRODUCT.	Leinster	Munster	Ulster	Connacht	Ireland
Crops—	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wheat ... ... per 112 lb.	0 12 0	—	0 12 7	—	0 12 3
Oats (White) ... ,,	0 12 3	0 11 3	0 11 4	0 10 8	0 11 7
,, (Black) ... ,,	0 11 5	0 10 2	0 9 1	—	0 11 4
Barley ... ... ,,	0 9 9	—	—	—	0 9 9
Potatoes ... ... ,,	0 7 5	0 5 7	0 6 0	0 4 7	0 6 2
Hay (1st & 2nd Years' Crop), ton	6 3 0	4 7 0	4 1 9	4 3 6	4 13 0
,, (Meadow) ,,	4 4 3	2 4 9	3 1 9	3 9 6	3 10 0
Grass Seed—					
Perennial per 112 lb.	—	—	—	—	—
Italian ,,	—	—	—	—	—
Flax ... ... per 14 lb.	—	—	0 14 0	—	0 14 0
Live Stock— per					
Calves, under 6 months head	3 13 9	2 18 3	3 6 9	4 7 6	3 8 3
Store Cattle—					
6 to 12 months ,,	8 4 9	7 15 0	8 9 6	8 11 6	8 4 0
1 to 2 years ... ,,	12 12 0	11 10 0	12 2 0	12 5 0	12 0 3
2 to 3 years ... ,,	16 13 0	14 15 6	14 19 3	15 14 9	15 11 3
3 years and over ,,	18 19 3	16 6 6	15 14 0	18 4 9	17 15 6
Fat Cattle—					
Under 2 years ,,	—	14 15 6*b*	—	—	14 15 6
2 to 3 years ... ,,	20 19 3	19 5 6	21 1 9	20 2 0	20 10 3
3 years and over ,,	22 8 0	21 11 9	19 12 9*b*	23 3 0	22 3 6
Cows and Bulls ,,	17 11 9	13 16 0	17 13 0	18 4 6	15 2 9
Springers (Cows and Heifers) ,,	20 4 3	18 9 0	20 4 6	19 19 0	19 16 6
Milch Cows (down Calved) ,,	18 6 0	17 10 6	17 16 9	17 4 9	17 18 0
Lambs, under 12 months ,,	1 19 0	2 2 6	2 3 0	1 18 6	2 0 0
Store Sheep—					
1 to 2 years ... ,,	2 9 0	2 12 3	1 18 9	2 16 9	2 13 3
2 years and over ,,	1 19 6	1 5 0*c*	2 0 0	3 16 6	2 6 6
Fat Sheep—					
1 to 2 years ... ,,	3 4 0	3 12 0	3 2 0	3 16 3	3 8 0
2 years and over ,,	3 8 3	3 18 3	3 8 3	4 13 3	3 13 0
Young Pigs, under 12 weeks ,,	0 17 9	1 4 9	1 8 9	1 5 0	1 5 9
Store Pigs—					
12 weeks to 4 months ,,	1 8 0	1 14 6	—	—	1 11 6
4 months and over ,,	2 4 0	2 7 9	—	—	2 6 9
Fat Pigs (other than Sows) ,,	3 18 0	5 10 6	5 8 9	—	5 2 3
Fat Sows ... ... ,,	—	—	—	—	—
Sows for Breeding ,,	—	—	7 0 0	—	7 0 0
Meat, Provisions, &c.—	s. d.	s. d.	s. d.	s. d.	s. d.
(*a*) Beef (Live) ... per 112 lb.	54 3	—	—	—	—
,, (Dead) ... ,,	95 0	—	—	—	—
(*a*) Mutton (Live) ,,	64 0	—	—	—	—
,, (Dead) ... ,,	112 0	—	—	—	—
Pork (Dead) ... ,,	78 9	77 3	83 6	72 0	78 3
Eggs ... ... per 120	10 5	9 0	9 3	8 8	9 9
Wool ... ... per lb.	1 6¼	1 3¾	1 0⅜	1 6½	1 5½

(*a*) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(*b*) Second class. (*c*) Mountain Type.

QUARTERLY AVERAGE PRICES FOR EACH PROVINCE, AND FOR IRELAND, OF CROPS LIVE STOCK, MEAT, PROVISIONS, &c., for the Quarter ended 30th September, 1928.

PRODUCT.	Leinster			Munster			Ulster			Connacht			Ireland		
Crops—	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Wheat ... ... per 112 lb.	0	9	6	0	9	11		—			—		0	9	7
Oats (White) ... ,,	0	10	9	0	7	4	0	10	6	0	9	8	0	9	0
,, (Black) ... ,,	0	9	9	0	7	4		—			—		0	9	6
Barley ... ... ,,	0	7	6	0	7	0		—			—		0	7	1
Potatoes ... ... ,,	0	6	4	0	6	3	0	4	10	5	0	0	0	5	5
Hay (1st & 2nd Years' Crop), ton	4	11	3	3	9	3	4	3	3	3	7	6	4	1	0
,, (Meadow) ,,	3	4	9	2	7	6	3	4	9	2	14	9	2	19	6
Grass Seed—															
Perennial per 112 lb.		—			—		0	15	1		—		0	15	1
Italian ,,		—			—		0	17	0		—		0	17	0
Flax ... ... per 14 lb.		—			—			—			—			—	
Live Stock— per															
Calves, under 6 months head	3	10	3	2	14	3	2	14	6	4	1	0	3	1	9
Store Cattle—															
6 to 12 months ,,	7	18	6	6	19	3	7	12	6	7	11	9	7	10	0
1 to 2 years ... ,,	12	0	3	10	19	9	11	9	3	12	0	0	11	9	9
2 to 3 years ... ,,	16	4	6	14	8	3	14	12	0	15	15	3	15	5	9
3 years and over ,,	18	4	3	16	10	9	15	9	9	19	0	9	17	15	9
Fat Cattle—															
Under 2 years ,,	17	3	3*b*	14	7	9*c*		—			—		14	11	0
2 to 3 years ... ,,	19	11	3	17	19	3	17	16	0	18	3	9	18	10	0
3 years and over ,,	21	11	3	20	2	0	18	3	3	20	8	6	21	0	9
Cows and Bulls ,,	15	10	0	12	18	6	14	10	6	18	4	0	13	9	6
Springers (Cows and Heifers) ,,	20	13	6	18	5	0	20	10	9	20	7	6	20	4	0
Milch Cows (down Calved) ,,	18	16	0	17	10	3	18	5	6	17	19	0	18	6	9
Lambs, under 12 months ,,	1	18	0	1	19	9	1	16	0	1	19	9	1	18	0
Store Sheep—															
1 to 2 years ... ,,	2	13	9	2	12	9	2	6	9	3	3	3	2	12	0
2 years and over ,,	2	8	3	1	13	3*d*	2	1	3	2	16	9	2	9	0
Fat Sheep—															
1 to 2 years ... ,,	2	18	3	3	3	0	2	13	9	3	6	6	3	0	9
2 years and over ,,	2	15	3	3	4	6	2	8	3	3	4	3	2	17	6
Young Pigs, under 12 weeks ,,	0	19	3	1	5	3	1	8	0	1	6	0	1	5	6
Store Pigs—															
12 weeks to 4 months ,,	1	9	9	1	13	0	1	16	3		—		1	11	6
4 months and over ,,	2	1	3	2	8	3		—			—		2	6	3
Fat Pigs (other than Sows) ,,	4	15	0	5	8	0	5	5	0		—		5	3	0
Fat Sows ... ... ,,		—			—			—			—			—	
Sows for Breeding ,,		—			—		6	13	3		—		6	13	3
Meat, Provisions, &c.—		*s.*	*d.*		*s.*	*d.*		*s.*	*d.*		*s.*	*d.*		*s.*	*d.*
(*a*) Beef (Live) ... per 112 lb.		45	6		—			—			—			—	
,, (Dead) ... ,,		79	9		—			—			—			—	
(*b*) Mutton (Live) ,,		49	6		—			—			—			—	
,, (Dead) ... ,,		86	9		—			—			—			—	
Pork (Dead) ... ,,		78	9		76	9		78	0		70	0		77	0
Eggs ... ... per 120		13	4		12	6		13	0		12	0		13	0
Wool ... ... per lb.		1	$3\frac{7}{8}$		1	$5\frac{5}{8}$		1	$0\frac{5}{8}$		1	$3\frac{5}{8}$		1	$3\frac{3}{4}$

(*a*) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(*b*) First class, 12 animals. (*c*) Second class, 185 animals.

(*d*) Chiefly Mountain Type.

DISEASES OF ANIMALS IN IRISH FREE STATE.

The following statement indicates the position with regard to contagious diseases during the quarter ended 31st December, 1927:—

Anthrax outbreaks	—
Foot and Mouth Disease outbreaks	—
Glanders (including Farcy) outbreaks	—
Parasitic Mange outbreaks	1
Rabies outbreaks	—
Sheep Scab outbreaks	37
Swine Fever outbreaks	7
Swine slaughtered as diseased or suspected . . .	92
Tuberculosis outbreaks	555
Animals declared affected	579

The following statement indicates the position with regard to contagious diseases during the 12 months ended 31st December, 1928:—

Anthrax outbreaks	2
Foot and Mouth Disease outbreaks	3
Glanders (including Farcy) outbreaks	—
Parasitic Mange outbreaks	31
Rabies outbreaks	—
Sheep Scab outbreaks	149
Swine Fever outbreaks	163
Swine slaughtered as diseased or suspected . . .	1,715
Tuberculosis outbreaks	1,919
Animals declared affected	2,027

OFFICIAL DOCUMENTS.

Thirty-first List.

AN ROINN TALMHAIOCHTA.

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907.

Sections 8 *and* 14 (1).

List of names approved by the Department for use in connection with Margarine.

Crenora.
G. M. N. C.
Honeymoon.
Maid.
Maxim.
Muslin.
Saxon.

SRAID UACH MHUIRBHTHEANN,
(Upper Merrion St.),
BAILE ATHA CLIATH,
31*st March*, 1928.

Thirty-second List.

AN ROINN TALMHAIOCHTA.

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907.

Sections 8 *and* 14 (1).

List of names approved by the Department for use in connection with Margarine.

Barn.
Blue Bird.
Charmo.
Cocahead.
Cocall.
Cocaxell.
Darlings.
Dello.
Double Four.
Echo.
Floss.
4 * 4
Golden Ball.
Green Bird.
Home Pride.
Marvello.
Minco.
Nelrose.
Onyx.
P. G.
Plough.
Raisine.
Redbreast.
Sanella.
Sungold.
Tomor.
Turquoise.
Whippa.

GOVERNMENT BUILDINGS,
DUBLIN, C.17.
30*th June*, 1928.

Thirty-third List.

AN ROINN TALMHAIOCHTA.

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907.

Sections 8 *and* 14 (1).

List of names approved by the Department for use in connection with Margarine.

All In.
Aunt Annie's.
Blue Moon.
Brito.
Britox.
Coastguard.
Competition.
Competitor.
Coxcomb.
Dunmarg.
Engo.
Four o'Clock
Frisk.
Galoa.
Handyman.
Headlight.
Heron.
Hollyhock.
Humpty Dumpty.
Hurricane.
Kentosa.
Kreedo.
Kriss Kross.
Lifeline.
Lighthouse.
Lightning.
£. S. D.
Marguerite
Market Day.
Messmate.
Minaret.
Minstrel.
Phantom.
Polo.
Premo.
Quicksands.
Quicksilver
Reynard.
Rotary.
Seabreeze.
Seashell.
Secay Brand.
Senior.
Silver Chimes.
Silver Flake.
Silver Moon.
Silver Star.
Silver Strand.
Skahai.
Thistledown.
Tiff.
Trivet.
Unifood.
Veteran.
Viola.

GOVERNMENT BUILDINGS,
DUBLIN, C.17,
29th September, 1928.

Thirty-fourth List.

AN ROINN TALMHAIOCHTA.

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907.

Sections 8 *and* 14 (1).

List of names approved by the Department for use in connection with Margarine.

Castleton.
5 o'Clock.
Just Out.
Kingway.
Luna.
McDonnell's.
Monogram.
Signet.
Speaker.
Square.
Squatta.
Squatter.
Tyne Towns.
W. & M.

GOVERNMENT BUILDINGS,
DUBLIN, C.17.
January, 1929.

B 8333. Wt. P. 366—1476. 3, 3, 1,250. 2. 1929.—A. T. & Co., Ltd.

Vol. XXVIII. No. 2.

DEPARTMENT OF AGRICULTURE

JOURNAL

The Department's Policy in Regard to the Improvement of Cattle and Swine—Field Experiments, 1928—Seed Testing—Report on the Work of the Seed Propagation Division, 1927—Estimation of Yeasts and Moulds in Butter—Report on Large Scale Wheat Experiments, 1926-27—Obituary Notice: Capt. C. J. McCarthy—Notes and Memoranda—Statistical Table.

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CONTENTS.

THE DEPARTMENT'S POLICY IN REGARD TO THE IMPROVEMENT OF CATTLE AND SWINE.

Paper read by the late CAPTAIN C. J. McCARTHY, A.R.C.Sc.I., *at the Annual Congress of the Irish Dairy Shorthorn Breeders' Society, held at Thurles on 2nd Jan.*, 1929.

Suitability of Ireland for Stock Raising.

Whatever changes may take place in the Agricultural economy and practice of other countries, the Irish Free State seems destined to remain, for many years to come, "the fruitful mother of flocks and herds." Our people are more expert in the breeding and rearing of live stock than in other branches of agricultural production. The mild climate and excellent pastures, which enable the stock to run out of doors for the greater part of the year, are important factors contributing largely to the growth and development of robust, thrifty animals. The world's greatest market for these, alive or dead, is at our door, open to receive more and more supplies.

Our live stock trade with Great Britain is by far the greatest and most important of its kind between any two countries in the world. Including the poultry group, the returns from live stock and live stock products, such as cream, butter, bacon, wool, hides, skins, &c., constitute 75 per cent. of our total export trade. Live stock, therefore, may be regarded as the backbone of our whole agricultural system, and the cattle breeding industry occupies a predominant position.

In June, 1928, we had a total of 4,125,145 cattle in the Free State. Of these 1,314,437 were cows and in-calf heifers. Our exports of live cattle for the past three years have been as follows :—

in 1926 = 635,906,
in 1927 = 645,911,
in 1928 = 748,767.

Live Stock Policy.

In view of these figures it is of fundamental importance that we should have a well considered and definite live stock policy. In forming and giving effect to such a policy we must be guided by (*a*) the suitability of the country to produce certain types of cattle ; (*b*) the special requirements of our markets. We must endeavour to breed especially cattle for which our soil and climate are suited, animals that will give the maximum return for food consumed ; be marketable at an early age, and that will, in addition, meet the special demands of the market. These factors should be made to harmonise as far as practicable.

The output of our cattle industry may be divided as follows :—

(*a*) Dairy Produce ; (*b*) Stores and Beef.

Including both export and home consumption, the total output of Dairy Produce may be valued at about £8,000,000 per annum, and the total production of stores and beef at about £18,000,000.

Although the figure for Dairy Produce is relatively small, it does not follow that the dairying side of farming is of secondary importance. The dairy cow, well and deservedly styled "the foster-mother of the human race," is the basis from which springs the wealth of the whole cattle industry.

The dairy farmer is the breeder of the store cattle and as the receipts from the sale of stores form a large part of his income, it is evident that he must possess cows that are not only good milkers, but of a type likely to produce good store and beef animals as well.

In view of the large return from stores and beef cattle, the Irish farmer cannot afford to concentrate on developing only the milking capacity of his cows. Increasing the milk yield is important, but it should be brought about as far as possible, in conjunction with a progressive improvement in the quality and early maturity of the store and beef animals produced.

As the whole industry depends upon the dairy cow, it is of primary importance to breed and develop the type most suitable for our conditions. We must have a cow capable of producing a good quantity of milk as well as a calf which will sell well as a store, or be capable of maturing into a well-meated beast at a comparatively early age. In other words we must have a *dual purpose cow*. Can we breed such an animal? We know it can be and is being done. Some experts who visited the Free State in 1928 stated on their arrival it could not be accomplished. Before these men departed from our shores, after having seen some of our Dairy Shorthorns they were not quite so emphatic in their pronouncements. A few were completely converted, owing to the outstanding dual-purpose character of the herds they had seen.

Fortunately the very foundation of our live stock industry is based on an animal of this description. The vast majority of the cows of this country are of Shorthorn type and character, with good milking capacity, and capable, if properly mated, of producing progeny eminently suitable for the requirements of the markets, either as store or beef cattle.

Type of Cow selected for Registration.

In making selections of cows for registration under the Department's Dairy Cattle Scheme, the tall, badly shaped animals are eliminated. Preference is given to the short-legged, deep-bodied cow, showing nice shapes and quality, combined with a good robust constitution and well-shaped udder. By mating these with good bulls of dairy strain, progressive improvement towards the ideal dual-purpose cow of nice quality, capable of producing a good calf and 800 gallons of milk and upwards each year, can be attained. With a further development of the policy of locating Dairy Shorthorn bulls of outstanding merit in the dairying areas, the future replenishing of our dairy herds should be assured.

Having regard to the large number of suitable cows we possess there is ample scope to breed sufficient good dual-purpose animals for our dairy herds as well as for breeding a substantial proportion of cattle specially suited for beef.

Our Market for Live Cattle and Beef.

Here we must consider our market and endeavour to cater for its special requirements. Great Britain is practically our only market. In 1927 Great Britain took 85 per cent. of our products, Northern Ireland 11 per cent. All the other countries between them took only 4 per cent.

Great Britain produces only about 52 per cent. of her beef and veal requirements, 45 per cent. of her mutton and lamb, and only 42 per cent. of her pig meat. Over all she only produces about 48 per cent. of her total meat requirements, the balance, 52 per cent., is imported. Her markets are open to the surplus meat production of other countries and are the dumping ground for supplies from the ends of the earth. It behoves us, therefore, to foster and develop our cattle industry in the direction of breeding animals of earlier maturing character, feeding them well from birth and marketing them in good condition, for we are up against the competition of the chilled and frozen meat trade.

The world's output of chilled and frozen meat in 1927 amounted to 1,250,000 tons. Of this huge total Britain imported almost 75 per cent., viz., 946,776 tons.

The main source of supply of this chilled or frozen meat is South America, principally Argentine and Uruguay. These countries have three grades of exportable cattle :—Chillers, Freezers and Continentals. The very best of the plump well-bred young fat cattle are selected for the chilled beef trade, the second quality, quite good cattle, are selected for the frozen meat trade, and the third grade, which is mainly cow and coarse lean beef, is shipped, in a frozen state, principally to Southern Europe.

Chilled beef is usually of excellent quality, being the product of young animals largely of pedigree blood. Being only chilled, however, it must be consumed within about six weeks after being killed, otherwise it may become unsound. Frozen beef, on the other hand, though not so desirable a food, can be kept almost indefinitely.

This South American trade is highly organised and is linked up with a complete distributive system in these countries, to which supplies flow in with the greatest regularity.

Notwithstanding the activities of the freezing stations, however, and the fact that Britain is their dumping ground, there is not an over-supply of all meat. There is an over-supply of heavy carcases, but not enough of small joints. Our people, therefore, must cease to compete in the over-stocked market of heavy beef cattle and aim at providing a commodity for which there is still an unsatisfied and increasing demand.

Modern Trend in public demand.

One of the most remarkable developments in connection with the question of meat consumption in recent years has been the growing demand for smaller, more tender, and more succulent joints. The trend of the public taste appears to be veering more and more in this direction. The high-class

trade is now chiefly concentrated on beasts finished at an early age and which show a good depth of flesh on the more valuable parts, viz., the ribs, the loin, and the round.

The well-bred, well-finished animal, weighing from 8 to 10 cwt. live weight, at about 2 to 2½ years old is most in request. The older and heavier cattle, weighing around 12 cwt. and upwards, are not in keen demand, and have to be sold at lower prices, sometimes on a par with chilled beef. Coarser and heavier animals are sold for little more than frozen beef, and in the end of Autumn each year, when a glut of these heavier beasts is on the market, the price per lb. which they realise is usually at the level of imported frozen meat.

The smaller, well finished young beast will always be keenly bid for, and will sell at an enhanced price. It is in this direction the Irish farmer must concentrate in future, viz. :—to breed better cattle of earlier maturing type, to feed them well from birth, and to market them in finished condition before they pass the age and size at which they provide the most saleable joints.

Unless we are prepared to work on these lines and aim at supplying the trade in nice, well-meated young cattle of medium weights, we will suffer more and more from the effects of the growing competition of huge supplies of chilled meat from South America and other countries which provide the British Markets with the heavier carcases.

We can, however, get in ahead of the chilled beef by specializing in better breeding, better feeding of the stock from birth, and finishing them for the beef trade at an early age. The chilled beef trade cannot very well compete with this particular form of agricultural production, except to a very limited extent.

Department's Policy to help in solving this Problem.

The Department's policy to help in this direction is working along two definite lines.

(1) By largely increasing the number of premium bulls.

(2) By the operation of the Live Stock Breeding Act, 1925.

With regard to the premium bull system it is interesting to note that Ireland was one of the first countries in the world to adopt this method of grading up and improving cattle. In 1887 the Royal Dublin Society were given a Government Grant to be expended in the improvement of live stock, including cattle. They adopted the method of subsidising pedigree sires and thus was launched the premium bull system. The Department of Agriculture came into being in 1900 and, with the concurrence of the Society, took over this grant in 1901. The premium bull system was then developed rapidly. In 1902 the 32 Counties of Ireland took up the scheme and have since continued that policy.

The average number of premium bulls standing for service each year in all Ireland from 1902 to 1921 was about 1,000. In the Free State there has been a progressive increase in the number of premium bulls, more especially

since the advent of the Live Stock Breeding Act, 1925, as shown by the following table :—

Year		*No. of premium bulls.*
1922	...	764
1923	...	808
1924	...	964
1925	...	1,100
1926		1,663
1927	...	2,205
1928	...	2,505

In 1925 about 1 bull in every 25 standing for service was a premium animal, whereas in 1928, about 1 in every 9 bulls was of premium standard.

The number of premium bulls of each breed subsidised in 1928 was as follows :—

Shorthorn ...	...	670
Dairy Shorthorn	...	726
Aberdeen Angus	...	789
Hereford ...	...	151
Kerry ...	...	87
Galloway ...	...	82
TOTAL	...	2,505

In connection with the Department's policy of cattle improvement the premium bull has for many years played a prominent part. A large percentage of these bulls are of Dairy Shorthorn ancestry and are widely distributed in the dairying areas. These and their progeny are gradually enabling the dairy farmers to grade up the cattle to a desirable level of merit. Intermingled with premium bulls are Special Dairy bulls located with members of Cow Testing Associations. The cumulative effect of these outstanding sires is evident in the great improvement in shape, size for age, substance and quality of the young non-pedigree Dairy Shorthorn bulls presented for inspection at the principal shows throughout the country. To any close observer this improvement is indeed remarkable. A few years ago it was usual to find a large proportion of the bulls presented at these shows of bad colours, poor shape, hard in the hide, and of poor quality. To-day, quite a number of these animals are of excellent colours generally, mossy of coat, soft in the skin, deep and symmetrical in the body and short in the legs. Indeed it is difficult to discern any difference between the level of merit of the best of them and that of pedigree animals. With the development of this type of bull from the non-pedigree Dairy Shorthorn cows of the country and with the wide distribution of pedigree Dairy Shorthorn sires of outstanding merit we can be assured of maintaining and improving the quality of the cows and heifers for dairy requirements, and at the same time establishing suitable foundation stock for the production of early-maturing, saleable cattle where it is found desirable to adopt crossing with bulls of the beef breeds. But

it is all important to bear in mind that the more closely these cows approach to the Shorthorn ideal the more profitable will it be to mate them with beef bulls.

Distribution of premium bulls of various breeds.

I.—*Galloway.*

The *Galloway* is confined to the highlands of Connaught and Donegal. In these cold, bleak regions, clad with little else but sedge and heather, where dairying, even in a small way, is out of the question, the Galloway serves a useful purpose. In fact it is doubtful if any other breed of cattle would exist there. The Galloway is favoured by nature with two coats of hair. The long outer coat acts more or less like the thatch on a rick and protects the body from the wasting effects of the rain. Inside the "thatch" is a soft furry coat which enables them to stand intense cold without injury. They are rather slow to mature, but when finished make beef of excellent flavour and quality much sought for in the trade. They cross well with a white Shorthorn, producing the blue-grey cattle highly prized by the grazier and butcher.

II.—*Kerry.*

The Kerry is the only pure breed of Irish origin now in this country. It has existed for centuries in the old red sandstone regions of Southern Kerry and the Berehaven Peninsula, County Cork. Though a typical, active mountain animal, it milks well, and when brought down from its native mountains to better pastures, fattens readily too. The Kerry is a dual-purpose cow, and no other breed of cattle could equal it for milk production, both in quantity and quality, on the moor, heather, sedge and coarse grasses which form its chief diet on its native mountains.

For many years the Department of Agriculture had in view the importance of conserving this valuable breed of mountain cattle, but though a fair number of premium Kerry bulls was placed in the Kerry country each year, still, owing to the great demand outside Kerry for high class females of this breed, and the fact that some farmers in the mountain areas were breeding from inferior bulls, not of good Kerry type, comparatively little progress was made in raising the general level of merit of the breed in the more isolated and remote localities. Faced with such a position, special provision was made in the Live Stock Breeding Act, 1925, whereby a definite area was, with certain modifications, set aside exclusively for Kerries only. This is now known as the Kerry Cattle Area, and lies between the sea and a line drawn from the inner reaches of Dingle bay through Killorglin, Beaufort, Killarney, Headford Junction and southwards to Snave Bridge on Bantry Bay. Within that territory, with the exception of a few small patches of better class land, the cattle are now, after three years working of the Act, mainly black and of improved Kerry type. This is due to the licensing of Kerry bulls, and to the location of about 35 or 40 high class pedigree Kerry bulls there annually, under the Department's scheme.

III.—*Hereford.*

Bulls of this breed are located chiefly in Meath, Westmeath, Longford, Roscommon, Galway and Offaly. They are purely a beef breed. Nature has provided these animals with soft thick skins which enable them to live and thrive out of doors in almost all kinds of weather. Some of the land in the counties mentioned is low-lying, damp, rushy and does not provide sweet herbage. On such land, unsuitable for dairying, it is doubtful if the Hereford has any equal among other breeds of cattle as an economic proposition. It is quiet, hardy, a great outlier, and fattens easily. It therefore serves a most useful purpose in those low-lying areas of damp second-class land, where dairy farming is almost unknown.

IV.—*Aberdeen Angus.*

There is a comparatively large number of premium bulls of this breed spread rather widely amongst the various counties. They are excellent for crossing with a view to early beef. Their progeny sell well from an early age and mature into beef of nice handy weights when from 2 to 3 years old. The premium bulls of this breed are usually placed in areas of medium class land, and undoubtedly they have, in these districts particularly, been helpful to breeders, and their progeny have enhanced the reputation of our export cattle in no small measure. A proportion of high class bulls of this breed, more especially in the poorer grazing areas, is advisable in the interests of the cattle industry of the country as a whole. But it must be borne in mind that the more shorthorn blood you have in the cows with which these bulls are mated, the better the results in the cross-bred animals. It is little use mating them with small, poor common cows, for the Aberdeen Angus is not an improver in this respect like the Shorthorn.

V.—*Shorthorn.*

The Shorthorn may be regarded as the premier breed of cattle in the world. No matter what kind of stock it is mated with, the Shorthorn, through its extraordinary prepotency, has the faculty of imparting its own desirable characteristics to the progeny. Before the "improved" Shorthorn came into prominence through the work of the Collings from 1780 onwards, Shorthorns had been bred in the North East of England for over 200 years. The red, white and roans, therefore, have a very long history of utility to support their world-wide popularity of to-day. They fit in with any scheme of husbandry and their dual character of meat and milk production make them invaluable and peculiarly suitable for our conditions in this country, where milking capacity and the breeding of early maturing cattle, capable of producing a prime beef carcase must be, as far as possible, combined in our dairy cows. In this respect the Shorthorn has no equal.

Reviewing the distribution of our premium bulls, therefore, we find that for special reasons, climatic and economic, the Galloway plays a useful part in the highlands of Donegal and Connaught, where other breeds could hardly live. The Kerry has as sanctuary its native mountain region, where it has no compeer for meat and milk production. The Hereford is specially suited

for the poorer and damper areas of the Midlands, owing to its thick skin, robust constitution and special value as an outlier, more particularly where dairying is not carried on.

The Aberdeen Angus is most useful for mating with cows of Shorthorn type with a view to the production of nice saleable early maturing cattle.

The Shorthorn, which is widely distributed, and which comprises the majority of our cattle, is the backbone of our whole live stock husbandry, and it is essential in the nation's interest that this valuable breed should be fostered and developed so as to enhance its wonderful dual character—adaptibility for milk and meat.

(2) *Live Stock Breeding Act*, 1925.

Although considerable improvement has been effected in recent years through the introduction and extension of the premium bull system, yet, owing to the indifference of some farmers, and their tendency to breed from poor, badly-shaped bulls, without any definite aim in view other than to get the cow in calf, a certain proportion of weedy, unthrifty stock were being offered for sale at the various fairs and markets throughout the country. It was imperative in the national interest that a definite settled policy of cattle improvement, supplementary to the Premium bull system, should be inaugurated and developed, in order to grade up all our cattle rapidly.

The Live Stock Breeding Act, which became law in 1925, and which provides that all bulls of a prescribed age must be licensed, was specially designed to speed up this work. The policy is to licence only those bulls which are well developed for age, and of good shape, size, substance and quality. Bulls poor in shape, inferior in type, lacking in quality and size, and likely to beget indifferent progeny are rejected for licence and have to be castrated or sold for slaughter.

Number of Bulls inspected and Results.

Since the inception of this Act in the Autumn of 1925 some 66,713 bulls have been inspected. Of these 68 per cent. have been passed for licence and 32 per cent. rejected.

The details are given in the following figures:—

Inspection	*Number Inspected*	*Number Licensed*	*Number Rejected*	*Percentage Rejected*
Autumn, 1925 ...	19,460	15,432	4,028	22 per cent.
Spring, 1926 ...	13,544	9,809	3,735	27·5 do.
Autumn, 1926 ...	2,487	1,402	1,085	43·6 do.
Spring, 1927 ...	11,747	6,881	4,866	41·4 do.
Autumn, 1927 ...	2,654	1,538	1,116	42·5 do.
Spring, 1928 ...	13,288	8,478	4,818	36 do.
Autumn, 1928 ...	3,533	1,804	1,729	49 do.
TOTALS ...	66,713	45,340	21,373	32 do.

Already the good effects of this policy are becoming visible. More interest is now taken in the breeding of a better type of bull. The general level of merit of young bulls presented at the shows and sales throughout the country is rapidly improving. The improvement in our stores exported has created a good impression in Great Britain and as a sequel requests for particulars of the working of the Act have been received from many countries.

The Manchester issue of the "Daily Despatch" a short time ago made special reference to the improvement in Irish stores as follows:—

> "The British Ministry of Agriculture has been asked to consider the question of licensing all bulls in this country in order to improve the standard of English stock.
>
> The need of some measure of this nature has been forced upon the agricultural community generally by the fact that the store cattle now coming into the country from all parts of Ireland are far superior to the general run of stock to be found in this country. All bulls in Ireland are licensed and there is no doubt but effective results are now being observed."

In the October issue of "The Scottish Journal of Agriculture," Mr. Buchanan Smith in an article entitled "Live Stock Improvement and the Scrub Bull" stated that:—"It is impossible to ignore the position in both Northern and Southern Ireland. The Irish Store which used to be considered of inferior quality is now being preferred in certain Scottish Markets to the home-bred one."

It is well for us sometimes "to see ourselves as others see us," and this in addition to several other similar cross-channel references with regard to the improvement in our cattle should hearten us in maintaining the needful work of eliminating the poor type of bull. In a few years, at the present rate of progress, the general level of our cattle and beef products should be such as to enable them to compete successfully in the British markets with those from all other countries.

PIG BREEDING POLICY.

Our Markets.

In considering a national pig policy we must be guided mainly by the special requirements of the markets to which our supplies of pork and bacon flow. We must also keep a breed of pig which will make economical gains in weight for food consumed, and mature at an early age into a nice saleable carcase of lean meat.

Great Britain can absorb an almost unlimited supply of pork and bacon. Producing only about 42 per cent. of her total pig meat requirements, she imported in 1927 some £47,000,000 worth of pigs and pig products. The Irish Free State's proportion of this huge total was only £6,212,785. We come fifth in the race of suppliers, Denmark, The Netherlands, United States of America and Sweden being well ahead, while Canada comes closely behind.

The excellent quality and flavour of the best Irish bacon and pork is widely known and universally recognised. Its high repute is mainly due to the

suitability of the raw material from which it is produced. The pigs of this country are now mainly of Large White type. The foods on which they are fattened are usually of a most suitable kind, including milk, potatoes and meals. These foods help to produce a nice, lean, well-flavoured meat which is almost invariably able to command top price. But, in order to capture and hold a large portion of the pork trade of Great Britain, it will be necessary to produce the exact type of carcase required and to supply meat uniform in quality.

One Breed of Pig only.

Fortunately, the breed of pig which produces the first grade bacon, the Irish Large White, is also suitable for the production of nice lean pork of prime quality. As a national policy, therefore, we should aim at producing the one type of pig only in this country, the long, lean, thrifty, quickly maturing animal of the Large White breed. This breed of pig, given proper care and feeding, will be ideal for pork at from 60 lbs. to 90 lbs. dead weight, or can be converted into primest bacon at, or about, 1 cwt. 1 qr. 14 lbs. to 1 cwt. 2 qrs. 0 lbs. dead weight. It is, therefore, a question of vast importance for the country to discard unsuitable types, such as the short, thick, chubby pig overloaded with lard, which cannot, by any means, suit either the pork or bacon trade, and black pigs, which owing to their dark colour and their tendency to "seedy cut" (discoloration of the belly meat, due to the spread of pigmentation) cannot be converted into desirable bacon.

At the London Dairy Show, October, 1928, in the Whiteley Cup Competition for the best bacon carcases of any breed (three hogs and gilts), Large Whites were first, second and third.

At the recent Smithfield Show Large Whites took the principal prizes as follows :—

Live Classes.

Championship for pork pigs won by Large Whites.

Championship for baconers won by Large Whites.

Champion and Reserve for best single pig awarded to Large Whites.

Carcase Classes.

The Supreme Challenge Cup and Championship for best baconer was awarded to a Large White.

There is, therefore, one clear road to follow in pig breeding in the Irish Free State. It is a simple one, viz., the adoption of the Large White pig as our model, breeding from the best and most prolific strains of nice quality, long and deep in the side, smooth of the top line, with neat shoulders, trim, tidy, thick, firm bellies, good loins and well developed hams. Large White pedigree boars, like the Shorthorn bull in the cattle world, have the faculty of imparting their own desirable characters to their offspring, producing uniformity of shape, early maturity, and an abundance of lean to fat in the carcases.

SWINE IMPROVEMENT.

A considerable amount of attention has been given to the improvement of the Swine Breeding industry in Ireland. Various voluntary bodies, such as Bacon Curers' Associations, gave valuable assistance in this connection by placing pedigree boars for service in many districts. The Royal Dublin Society, however, was the first body in this country to receive a State grant for the purpose of live stock improvement including swine. This grant was given in 1887 and was administered by the R.D.S. up to 1900, when, with the concurrence of the Society, it was handed over to the Department of Agriculture.

The Department's scheme for swine improvement takes the form of subsidising the sire as in the case of premium bulls.

Two breeds only are recognised under this Scheme, viz. :—

(1) The Large White Ulster.

(2) The Irish Large White.

The Large White Ulster premium boars are now confined to the counties Monaghan, Cavan and Donegal. In all other counties boars of the Irish Large White breed only are subsidised.

The Large Ulster is suitable for the rolled bacon trade. It has very little hair, a thin skin, and is rather inclined to be overfat. Owing to its thin skin this pig is very easily injured in transit while alive. So the custom in the North is to kill the pigs on the farm and sell the carcases at the local market as dressed pork.

Though the Large Ulster appears to suit the rolled bacon trade with Glasgow and a few other centres, it is not a suitable breed for either the pork or bacon trade with England, unless it is crossed with a Large White boar.

In this connection it may be of interest to quote the following extract from a letter recently received from the Secretary of a Northern Branch of the Irish Farmers' Union, enclosing copy of a letter received from Messrs. Marsh and Baxter, Brierly Hill, Stafford, one of the largest firms of bacon curers in England.

Dear Sir,

"I wish to bring to your notice the enclosed letter and to ask you to do your utmost to have regulations made by the Department, in the near future, to prevent the keeping for service of Scrub Boars (or indeed of any but the Large White Irish Breed), and these should be selected of a high standard of quality."

* * * * *

Extract from Messrs. Marsh and Baxter's letter.

Dear Sir,

"We have this morning received and slaughtered the 49 pigs and 1 sow shipped *via* Holyhead, but we are very much disappointed with the type of pig and unless your members can feed and produce a

better type of pig altogether than these we are afraid we cannot continue to take them from you.

"Some of these pigs are of the Ulster type and are very soft whilst others are evidently crossed with a Large Black Boar and these are a very coarse and rough type of pig, they neither produce satisfactory bacon nor hams.

"We advise your members to use a Large White Boar which will give them a better type of pig."

* * * * *

In addition to above I recently received a letter from one of the largest buyers of live pigs in the South of Ireland from which the following is taken :—

"However, I can say, with assurance, that of the 6,465 pigs handled in 1926, only about 30 per cent. would be half, or full Large White, and that of the 12,204 handled for the 11 months of this year (1928), fully 60 per cent. were satisfactory quality of Large White breed. In fact, I occasionally get 100 per cent. Large White in some Markets. Another remarkable fact is that the people who have had to be forced into this breed are now very pleased and are astonished at the weight for age."

* * * * *

In recent years the Department have been very much alive to the necessity for placing more and more premium boars of the Irish Large White breed throughout the country and with the help of additional State grants supplemented by financial assistance from some of the principal bacon curers, a considerable increase in the number of high class boars located for service has been made as follows :—

Year		*No. of premium boars placed.*
1922	...	412
1926	...	910
1927 } 1928 }	...	an average of 1,100, of which 42 are Large Ulsters.

The total number of boars standing for service in the Free State is about 2,300. Almost half of these are of premium standard. Some of the non-premium boars are the progeny of pedigree sires and are, therefore, of fair standard. The balance are boars of poor type and are doing the swine industry a serious injury. In fact one large buyer of pigs considers that inferior boars inflict far more loss on the community than bad bulls. Here is an extract from his letter :—

"There has, undoubtedly, been a great improvement in the breed of pigs, due to the increased number of Premium Boars put out by the Department, but there are still far too many common boars. I have ample opportunity of judging the harm one of these scrub Boars may do in a district, and I would reckon the loss at £500 to £1,000

per annum. I reckon the average loss to the farmer on mongrel pigs at about £1 per head, and if you calculate that one Boar may serve 60 to 100 sows, and the average litter at 8 or 9, the figures are fairly correct."

Application of the Live Stock Breeding Act to Boars.

In view of the position of the swine industry in this country and the serious competition with which we have to contend in the British market, for our pigs and pig products, the time appears to have come, when we must more or less standardise our pork and bacon pigs. Haphazard breeding from mongrel boars cannot be allowed to lower the reputation of our best pork and bacon any longer. The time is ripe, therefore, for eliminating the "scrub" boar in the national interest.

It is proposed to apply the provisions of the Live Stock Breeding Act to boars at an early date, and thereafter all boars of the prescribed age will have to be examined and only those of a good type will be licensed for service purposes.

The standard required will not be too high at first for two reasons :—

(1) Boars are mainly kept by men of small means to whom the service fees are the main source of income. They will be given an opportunity of adjusting themselves to the change required.

(2) Owing to the fact that pigs come into use at a much earlier age and breed more rapidly than other farm animals, it should be possible to effect as great an improvement in our pig stocks in three years as could be achieved in our cattle in six years.

In the application of this Act to boars it is hoped to have the helpful co-operation of all concerned in swine husbandry, so that in a year or two a standard type of pig shall be established in this country, viz. :—the improved Irish Large White—the best pig for our conditions and the best pig in the world to-day.

The Dairy Shorthorn Breeders' Society has done useful work in connection with the development of the Dairy Cow. May I suggest that, in addition to furthering the interests of the Dairy Shorthorn, you will seriously take up the question of helping the swine husbandry of the country as well ? Each member who has accommodation available and suitable help should keep at least one brood sow and breed from her twice a year. A brood sow or two fit in admirably with dairy farming and give a quick turn-over on the capital invested.

A good cow will give a gross return of about £30 to £40 per annum. A sow will yield from £60 to £80 per annum where two normal litters are produced and sold as bacon pigs.

Efficiency of the pig for production of flesh.

For efficiency in converting vegetable food into flesh the pig is far superior to any other class of stock. A bullock usually takes 7 lbs. barley for every 1 lb. increase in live weight, a pig $3\frac{1}{4}$ lbs. As a bullock will kill at about 54 per cent. of its live weight and pigs at 75 per cent., it follows that the bullock requires 13 lb. barley for every 1 lb. of flesh produced, while the pig takes only $4\frac{1}{4}$ lbs. for every lb. of pork. For the production of human food in the form of meat, therefore, the pig is more than three times as efficient as the bullock. This point should be borne in mind by all who are interested in the development of pig breeding.

In conclusion I wish to lay particular emphasis on the importance of the Dairy Shorthorn cow and the Large White pig as two valuable assets to help farmers through the present lean times. They are the milestones on the road to economic independence.

If we concentrate on these two branches of husbandry, dairying and pig raising, develop the possibilities of both, and grow a larger proportion of the feeding stuffs required, we can face the future with confidence.

FIELD EXPERIMENTS, 1928.

The following report deals with Field Experiments conducted in 1928. These experiments comprised trials with varieties of the various crops, experiments on the manuring of pasture and tests designed to determine the value of lime.

The detailed returns in respect of each test conducted by Agricultural Instructors may be found in the Annual Reports issued by the County Committees of Agriculture, and farmers and others interested are recommended to apply for a copy of the report to the Agricultural Instructor or to the Secretary of the County Committee for the County.

I.—EXPERIMENTS WITH VARIETIES OF CROPS.

Wheat.

In pursuance of their efforts to secure a variety of wheat more suitable for general cultivation in this country than those varieties already available the Department's Seed Propagation Division have, for some years past, been engaged in the study of the old native varieties of wheat which are still cultivated in certain districts. A number of selections from these varieties were made and grown on a small scale during the past few seasons. In the Autumn of 1927 it was decided to include the most promising selections, in addition to Queen Wilhelmina and Yeoman II, two varieties which have been widely grown in recent years, in the small scale variety trials to be conducted by the Agricultural Instructors in the season 1927-28, and accordingly three varieties, Red Stettin, Coney Island (Short Straw) and Coney Island (Long Straw) were selected.

Red Stettin is a selection from an old native wheat which was formerly grown fairly widely in South Tipperary and variously described in that district as Red Stettin, "Red Satin" or "Red Velvet." It is a red grained wheat which produces a rather fine straw which bends easily but does not as a rule lodge badly. The chaff is of a red or brownish colour and covered closely with short fine hairs. The grain is dark red and thin skinned, and good samples present a somewhat flinty appearance. Samples of the grain of Red Stettin which were analysed were found to contain much higher percentages of nitrogen and gluten than any of the other Winter varieties usually cultivated in this country.

Coney Island (Short Straw) and Coney Island (Long Straw) were derived from two separate selections made from an old variety of wheat grown in Coney Island off the coast of Sligo. Both varieties resemble each other very closely; the only distinct observable difference being the length of the straw. The straw of both varieties is, however, rather weak and therefore liable to

District or County.	Nature of Soil.	Previous Crop.	Manures applied per Statute Acre.	Date of Sowing.	Date of Harvesting.
Cavan ...	Clay loam.	Potatoes.	Top dressed with 1 cwt. Sulphate of Ammonia.	22/11/27	23/8/28
Clare, W. ...	Med. loam.	Sugar Beet.	—	25/11/27	16/8/28
Clare, E. ...	Med. loam.	Potatoes.	3 cwt. Super., 3 cwt. Kainit, 1 cwt. Sulphate of Ammonia.	1/3/28	29/8/28
Cork, N.E. ...	Clay loam (old red sandstone).	Oats.	1 cwt. Sulphate of Ammonia. 4 cwt. Super., 2 cwt. Kainit.	16/11/27	24/8/28
Cork, S.E. ...	Heavy loam	Potatoes.	—	27/2/28	10/9/28
Cork, S.E. ...	Med. sandstone loam.	Oats.	3 cwt. Basic Slag, 1½ cwt. Kainit.	1/12/27	30/8/28
Cork, S.E. ...	Gravelly sandstone loam.	Potatoes.	—	27/2/28	4/9/28
Cork, Mid. ...	Heavy loam	Grass.	1 cwt. Sulphate of Ammonia, 3 cwt. Super., 2 cwt. Kainit.	16/11/27	21/8/28
Cork Mid. ...	Med. loam	Grass.	2 cwt. Kainit, 1 cwt. Sulphate of Ammonia, 3 cwt. Super.	5/11/27	9/8/28
Donegal ...	—	Potatoes.	1 cwt. Sulphate of Ammonia	4/2/28	1/10/28
Dublin ...	Clay loam	Potatoes.	—	17/11/27	22/9/28
Kerry, N. ...	Strong loam	Potatoes.	1 cwt. Sulphate of Ammonia	12/11/27	23/8/28
Kerry, S. ...	Med. loam	Potatoes.	—	24/2/28	—
Kildare ...	Clay loam	Potatoes.	—	28/11/27	31/8/28
Kilkenny ...	Med. loam	Sugar Beet	—	2/12/27	28/8/28
Laoighis ...	Heavy med. loam.	Sugar Beet	3 cwt. Super., 2 cwt. Kainit, 1½ cwt. Nitrate of Soda.	11/12/27	4/9/28
Longford ...	Heavy limestone.	Turnips.	Nitrate of Soda in Spring.	30/11/27	29/8/28
Louth ...	Light Clay.	Sugar Beet.	—	28/11/27	27/8/28
Meath ...	Clay loam	Potatoes.	—	26/11/27	4/9/28
Meath ...	Clay loam.	Potatoes.	—	9/11/27	29/8/28
Roscommon, N.	Clay loam.	Potatoes.	1 cwt. Nitrate of Soda.	3/11/27	7/9/28
Roscommon, S.	Limestone loam.	Potatoes.	1 cwt. Sulphate of Ammonia	—	29/8/28
Sligo ...	Med. loam	Potatoes.	1 cwt. Sulphate of Ammonia, 2 cwt. Super., 2 cwt. Kainit.	17/11/27	17/8/28
Tipperary, N.	Strong clay	Sugar Beet.	—	27/1/28	13/9/28
Tipperary, S.	Med. clay	Turnips.	—	21/2/28	6/9/28
Westmeath ...	Med. loam	Potatoes.	—	12/11/27	30/8/28
Wexford ...	Shingly loam.	Potatoes.	—	2/12/27	29/8/28
Wicklow ...	Deep loam	Potatoes.	1 cwt. Nitrate of Soda.	9/2/28	22/9/28
Wicklow ...	Med. loam.	Potatoes.	—	9/11/27	23/8/28
Wicklow ...	Med. loam	Potatoes.	—	15/11/27	4/9/28
	Average Yield per Statute Acre ...		Grain, 30 centres; Straw, 28 centres		...

Queen Wilhelmina.				Red Stettin.				Coney Island (Long Straw).				Coney Island (Short Straw).				Yeoman II.			
Yield per Statute Acre.				Yield per Statute Acre.				Yield per Statute Acre.				Yield per Statute Acre.				Yield per Statute Acre.			
Grain.		Straw.		Grain.		Straw.		Grain.		Straw.		Grain.		Straw.		Grain.		Straw.	
C.	Q.	C.	Q.	C.	Q.	C.	Q.	C.	Q.	C.	Q.	C.	Q.	C.	Q.	C.	Q.	C.	Q.
19	0	32	0	19	2	30	0	16	3	30	0	24	0	30	0	20	2	32	0
22	0	33	3	18	2	37	0	15	3	29	2	15	0	25	3	18	2	30	0
16	1	31	2	15	0	34	1	17	1	34	3	13	1	30	0	15	0	31	0
8	1	14	2	10	1	17	3	12	2	20	3	10	0	16	1	9	0	16	0
22	0	34	0	13	1	33	0	12	0	26	1	11	0	22	2	—		—	
12	1	19	0	9	0	24	0	8	1	20	1	7	3	17	0	4	0	12	3
15	0	19	3	11	0	19	3	13	3	18	3	13	0	19	0	—		—	
8	1	12	3	10	3	19	1	7	1	13	0	7	0	15	2	5	2	14	2
22	0	47	1	24	2	50	2	13	3	42	0	18	0	42	2	14	1	36	3
7	0	—		12	1	—		16	2	—		16	0	—		12	0	—	
22	3	34	2	24	1	43	0	16	3	29	3	25	3	35	3	27	2	39	1
19	3	39	2	23	2	46	0	16	2	27	1	18	3	30	1	18	0	42	1
18	0	—		18	0	—		17	0	—		17	2	—		16	3	—	
18	1	50	2	20	3	50	1	15	2	46	1	17	3	44	3	19	2	48	3
20	2	37	0	18	0	46	2	21	0	38	3	19	3	32	2	18	2	33	2
19	2	41	2	18	2	38	2	18	3	40	1	18	1	37	2	18	3	39	1
25	3	42	2	24	1	41	2	21	3	36	2	26	3	44	1	24	1	60	3
17	0	—		16	0	—		11	0	—		18	2	—		17	3	—	
32	0	60	2	27	3	58	0	19	0	43	2	28	2	45	0	24	2	44	3
26	1	58	3	23	1	55	3	21	3	42	0	26	1	41	2	24	0	47	0
21	2	39	0	18	2	38	3	13	1	36	0	17	0	35	2	18	1	38	2
16	1	27	3	23	2	29	1	20	1	29	3	21	2	28	2	25	1	31	1
20	3	23	2	23	2	30	0	18	1	20	0	17	0	18	3	19	3	20	1
24	2	25	2	24	0	29	3	19	2	23	0	25	3	24	2	21	2	16	3
22	0	47	0	23	2	48	2	20	1	34	1	18	0	31	2	24	2	40	0
25	1	36	2	27	2	36	1	24	2	33	3	22	3	30	2	24	3	35	3
21	0	35	0	24	1	44	1	20	3	30	3	20	2	23	2	16	0	23	0
23	2	41	0	21	3	44	2	20	2	43	0	22	1	43	0	17	3	40	0
22	2	38	0	18	2	45	0	20	0	43	2	21	3	41	0	21	1	40	0
21	2	39	0	20	1	40	3	19	1	41	0	19	2	40	2	18	3	38	0
19	1	35	2	19	2	38	1	17	0	32	2	18	2	31	1	17	1	31	2

lodge in unfavourable seasons. The chaff is brown and free from hairs and the grain is of a yellowish red colour. In general these two varieties somewhat closely resemble Square Head Master, but in such trials as have been conducted they have proved to be more resistant to rust diseases than that variety.

Supplies of Seed of Red Stettin were obtained from the produce of a Department's Extension plot grown in South Tipperary in 1927. Coney Island (Short Straw) was supplied from the Albert Agricultural College, Glasnevin, and Coney Island (Long Straw) was obtained from the Agricultural Station, Athenry. Seed of Queen Wilhelmina and Yeoman II. was obtained from Seed Merchants.

The experiment was conducted at 39 centres in 26 counties. At three centres the crops on all the plots grew so poorly during the Winter season that they were ploughed up in Spring. At two other centres the crops were so patchy and weedy that reliable returns could not be obtained, while in two other cases reports have not been furnished. At the remaining 30 centres weighings were made and the detailed returns are shown in the Table on pages 150-151.

Reports received at the beginning of Spring from the centres where the seed was sown in winter and from which results were eventually obtained indicated that all varieties, with the exception of Yeoman II. withstood the Winter well. In most cases, however, Queen Wilhelmina developed more rapidly during this period than any of the other varieties included in the trials. Similar reports on the condition of the crops on the different plots at the end of May showed that Queen Wilhelmina presented a slightly better appearance and looked more vigorous at this stage than any of the other varieties. Yeoman II. while relatively not so backward at this stage as at the beginning of Spring was much inferior in general appearance to the other varieties. It is, of course, well known that the Yeoman type of wheat develops slowly during the Winter and Spring months and consequently it is very liable to injury at this period in unfavourable seasons or when sown under unsuitable conditions. At two centres in County Cork the Yeoman II. seed developed very poorly and eventually died out almost completely with the result that there were no returns from this variety at these two centres. Comparatively poor yields were produced by the other varieties at these centres also. The failure of Yeoman II. and the inferior yields from the other varieties may have been mainly due to the fact that the crops were not sown at these two particular centres until the end of February.

All the varieties were ripe for harvesting at about the same time. In a number of cases, however, Yeoman was ready for cutting a day or two before the other varieties and at most centres Coney Island (Long Straw) appeared to be somewhat more ripe at harvesting time than Coney Island (Short Straw). There was very little lodging on any of the plots except in the case of Coney Island (Long Straw) at a small number of centres.

The average yields produced by each variety are relatively low, mainly however, on account of the very poor returns from five out of the six centres where the experiment was conducted in County Cork. The season of 1928, too, was not, especially in some districts, favourable to the development of corn crops, and the average yield for the whole country in the case of wheat was much lower than in the previous year. Red Stettin and Queen Wilhelmina produced practically equal returns of grain and proved superior in this respect to the other varieties. Of the two strains of Coney Island, the Short Straw variety gave the better yield, and as it is also less liable to lodging than the other strain it appears to be the more promising of the two. Yeoman II. compared much less favourably with Queen Wilhelmina than it did in similar trials conducted in the previous year, and in these experiments it also gave a lower yield than Red Stettin or Coney Island (Short Straw). From a few centres too it was reported that the grain produced by Yeoman II. was of poor quality.

All varieties appear to have been singularly free from disease of any kind. While it is not possible as a result of one season's tests to form a definite opinion as to the value of the new varieties introduced into these trials, it is evident that Red Stettin and Coney Island (Short Straw), particularly the former, are capable of producing satisfactory returns. Arrangements have already been made for the conduct of trials with the same varieties in the season of 1928-29.

Oats.

In the past season the trials with oats were confined to white varieties. Two series of experiments were conducted (*a*) a series in which Victory II, Banner-Tartary, Victory-Mogul and Mansholts III. were compared and (*b*) a series of trials with three strains of Potato Oats. As in the similar tests conducted in previous years the varieties included in these experiments were confined to pure line selections of the several varieties tested.

Trials with Victory II.; Banner-Tartary; Victory-Mogul and Mansholts III.

Victory II. which has been included in these variety trials for the past few seasons, and which is one of the most popular varieties of oats grown in this country was included as the standard for comparison with the other varieties. Banner-Tartary, which has been fully described in previous reports, had also been included in these trials during the previous two seasons in each of which it produced a slightly higher average yield of grain than Victory II.

Victory-Mogul is a new variety introduced by the Department's Seed Propagation Division and derived from a crossing of the Department's pedigree strain of Victory with the similar strain of Black Mogul. It resembles the Victory parent rather closely except that it tillers better, and the head is somewhat more branched or widespreading. The grain too is white in colour, whereas that of Victory is yellow.

Mansholt's III. is a variety of Dutch origin, a small quantity of which was obtained from the producer, Dr. R. J. Mansholt, Ulrum, Westpolder, Holland, in the spring of 1925. It produces a rather short stiff straw and a white thin skinned grain which rather resembles the grain of Banner. In the small scale trials which have been conducted at a limited number of centres in the past two seasons it has germinated quickly, developed rapidly in the early stages of growth, yielded satisfactorily and ripened earlier in the season than Victory II.

In the season of 1928 trials in which all four varieties were included, were conducted at 22 centres in 15 counties. The detailed returns from the different centres and the average yields from all centres are shown in the following Table :—

District of County.	Character of Soil.	Yields per Statute Acre.							
		Victory II.		Banner-Tartary.		Mansholt's III.		Victory-Mogul.	
		Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
		C. Q.	C. Q.	C. Q.	C. Q.	C. Q.	C. Q.	C. Q.	C. Q.
Carlow ...	Medium loam ...	20 1	37 1	18 2	25 0	18 1	31 2	19 3	37 2
Clare, W. ...	Medium loam ...	30 0	48 3	27 0	41 0	21 2	28 3	28 2	40 0
Clare, E. ...	Medium loam ...	17 2	38 2	21 1	35 0	19 0	30 2	16 3	36 2
Cork, N.E.	Medium loam ...	21 0	29 3	21 3	35 2	19 2	30 3	21 2	30 3
Cork, S.E.	Medium limestone loam.	17 3	—	14 0	—	16 2	—	16 2	—
Cork, Mid.	Light loam ...	28 1	54 2	24 1	47 1	18 2	46 0	25 1	48 1
Cork, N.W.	Heavy clay loam ...	22 1	41 0	22 0	46 2	20 3	39 3	26 0	49 3
Cork, W. ...	Sandy loam ...	25 3	40 3	20 1	40 3	18 1	38 2	20 0	39 1
Dublin ...	Light loam ...	23 2	27 3	19 3	29 3	21 2	26 1	20 0	25 0
Kerry ...	Medium loam ...	24 2	32 0	25 0	32 2	19 2	27 2	23 3	31 0
Kerry ...	Medium loam ...	26 0	38 2	27 0	37 0	33 0	47 0	29 1	39 3
Kildare ...	Light loam ...	19 3	33 3	17 3	29 1	18 2	34 1	20 1	32 0
Laoighis ...	Loam	19 1	38 0	21 0	38 2	18 3	34 1	18 3	35 3
Louth ...	Clay loam ...	34 3	29 3	34 2	45 3	39 3	36 2	39 1	41 0
Limerick ...	Medium loam ...	21 1	34 0	23 2	50 0	22 3	46 0	20 2	44 0
Offaly ...	Strong loam ...	28 1	41 0	26 3	36 2	25 0	33 3	29 3	37 0
Tipperary, N.	Black loam ...	29 2	36 0	24 1	31 0	20 2	28 0	23 1	34 0
Tipperary, S.	Medium clay ...	21 2	34 1	19 0	28 0	21 1	32 2	20 2	32 0
Waterford...	Medium loam ...	21 2	45 2	22 1	54 0	19 2	44 1	22 2	52 2
Westmeath	Gravelly loam ...	18 1	31 2	25 2	36 1	23 2	33 3	23 3	35 3
Wexford ...	Shingly loam ...	19 0	28 3	20 2	27 1	20 3	30 1	21 2	28 0
Wicklow ...	Medium clay loam	22 1	33 0	20 3	32 0	20 1	30 0	22 0	33 0
Average yield per statute acre (Grain, 22 centres; Straw, 21 centres).		23 3	36 3	22 2	37 0	21 3	34 3	23 1	37 2

Victory II. produced the highest average yield and the grain of this variety was, at the majority of the centres, said to be of better appearance and quality than that of any of the other varieties included in the experiment. Victory-Mogul was but slightly inferior in yielding capacity to Victory II. and in nearly all cases the grain was well filled and of good quality. Banner-Tartary, which in similar trials conducted in the two previous seasons proved more prolific than Victory II, gave a lower average yield than the latter or Victory-Mogul, but was distinctly superior to both of these varieties as regards resistance to lodging. Mansholt's III. germinated quickly and grew more vigorously in the earlier stages of growth than any of the other three varieties. It produced rather short stiff straw which resisted lodging better than Victory II. or Victory-Mogul, but not so well as Banner-Tartary. In yielding capacity Mansholt's III. was inferior to the other three varieties. Victory II, Victory-Mogul and Mansholt's III. ripened at about the same time in most cases, and at nearly all centres Banner-Tartary was distinctly later in ripening than the other varieties.

Trials with different strains of Potato Oats.

A number of years ago the Department's Seed Propagation Division made a selection from ordinary commercial potato oats which was widely propagated and which is now described as Potato (1). More recently two further selections which are described as Potato (2) and Potato (3) were made from commercial stocks of Potato Oats.

Potato (1) with which most farmers are familiar, has, under the Department's schemes for the distribution of pure seed, been distributed widely over a number of years throughout the districts in which this variety is usually grown. It is typical of the familiar type of potato oats producing stems and leaves covered with short hairs and a slightly awned white grain. Both Potato (2) and Potato (3) resemble Potato (1) rather closely, but they differ markedly from it and from each other in some respects.

Potato (2) like the typical potato oats produces stems and leaves covered with short fine hairs. The grain, however, which is distinctly awned is of a pink shade of colour, and therefore, quite distinct from Potato (1) which has a white grain.

Potato (3) unlike the other two strains produces stems and leaves which are free from hairs. The grain of this strain is white like that of Potato (1) and has a well developed awn as has Potato (2).

Trials were conducted with the three strains of Potato Oats at 13 centres in the districts in which the potato variety of oats is usually grown. The detailed returns obtained at the different centres and the average yields from all centres are shown in the following Table :—

District or County	Character of Soil	Potato (1) Yield per statute acre Grain	Potato (1) Yield per statute acre Straw	Potato (2) Yield per statute acre Grain	Potato (2) Yield per statute acre Straw	Potato (3) Yield per statute acre Grain	Potato (3) Yield per statute acre Straw
		C. Q.	C. Q.	C. Q.	C. Q.	C. Q.	C. Q.
Cavan	Clay loam	16 3	28 0	15 2	32 0	18 3	32 0
Donegal	Light loam	18 1	35 1	19 2	36 2	20 1	35 0
Galway S.	Limestone loam	20 0	35 0	18 0	34 0	19 0	36 0
Galway N.	Clay loam	16 3	27 0	16 0	27 0	17 2	28 0
Leitrim	Heavy clay	15 2	32 2	16 0	34 0	16 1	34 3
Longford	Heavy loam	24 2	36 3	23 3	35 3	22 3	36 1
Mayo S.	Moory loam	21 3	34 2	19 3	36 3	18 0	35 2
Mayo N.	Medium loam	22 1	37 2	22 0	37 3	21 3	35 1
Meath	Clay loam	17 1	34 2	22 1	35 3	25 2	37 0
Monaghan	Heavy clay loam	12 3	26 1	14 0	28 2	16 1	29 3
Roscommon S.	Medium loam with little gravel ...	28 0	—	20 3	—	26 3	—
Roscommon N.	Sandy	21 3	32 2	20 1	30 2	22 2	33 1
Sligo	Medium loam	21 1	29 3	22 0	31 2	24 2	35 1
	Average yield per statute acre { Grain 13 centres; Straw 12 ,, }	19 3	32 2	19 1	33 1	20 3	34 0

Potato (3) produced the highest average yield of grain, and this strain also gave the best yield at eight of the thirteen centres at which the trials were conducted. At nearly all centres, however, it was found that it ripened later than the other two strains and in a few cases it was not ready for harvesting until ten days after the others were cut.

Potato (2) proved inferior in yielding capacity to each of the other strains, but at almost all centres it ripened first.

All three strains produced good quality grain, and there was practically no lodging on any of the plots. Apart from the ripening at different periods, there was no noticeable difference in the general habit of growth of the different strains.

Potatoes.

Trials were again conducted with four varieties of potatoes, and, as in the previous year, the "seed" of all varieties, which was the produce of certified stocks, was procured from one centre in County Donegal. Tests were conducted at one or more centres in each county in the Saorstat, and the average yields obtained per statute acre as well as the average yields obtained in the similar trials conducted in 1927, are shown in the following Table:—

Variety	Average yield per statute acre, 1928 (43 centres)				Average total yield per statute acre, 1927 (56 centres)
	Saleable	Small	Diseased	Total yield	
	T. C.	T. C.	T. C.	T. C.	T. C.
Kerr's Pink	10 18	1 17	– 4	12 19	14 17
Up-to-Date	10 17	1 11	– 7	12 15	14 7
Arran Consul ...	10 15	– 18	– 3	11 16	14 13
Old Champion ...	8 6	2 2	– 12	11 0	11 13

Arran Consul, which was included for the first time in these trials in 1927, and which in that season produced a heavy yield proved disappointing in the past season's trials. From over one-third of the centres where the trials were conducted it was reported that a considerable number of failures or "misses" occurred in this variety, and it was generally found that in comparison with the other varieties included in the trials it made very slow progress in the early part of the season. At a few centres too, this variety was affected with "Black Leg" or "Black Stalk Rot," and it is probable that this disease was responsible for a number of the failures which occurred.

Root Variety Trials.

As in the previous season Instructors were again asked to include in the root variety trials, in addition to those varieties which had given the best results in previous tests, such varieties of Swedes and Mangels supplied by Irish Seedsmen as were proprietary to such firms, and which could be regarded as distinct varieties and likely to produce good results.

In the mangel variety trials which were conducted at over 40 centres Red Intermediate, Yellow Globe and Lord Warden were included at all centres, and the average yield per statute acre produced by each of these varieties was as follows:—Red Intermediate 30 tons 3 cwt.; Yellow Globe 29 tons 1 cwt.; Lord Warden 28 tons 14 cwt.

In the tests with different varieties of Swedes, which were conducted at over 50 centres, Magnificent and Tipperary, which had given the best returns in the previous trials, were included in all cases. The average yields per statute acre produced by these two varieties were, Magnificent 28 tons 13 cwt., and Tipperary 28 tons.

In addition to these varieties of mangels and Swedes a number of other varieties were included at practically all centres. As, however, different varieties were included at the various centres at which the trials were conducted, it is not possible to furnish particulars of the average yields produced by the numerous varieties included in the trials. The detailed returns obtained in each test have, however, been published in the Annual Reports issued by the various County Committees of Agriculture in the Saorstát.

Grass Seed Mixtures.

During the season of 1926 a series of experiments were laid down by Agricultural Instructors at 37 centres with the object of determining the relative value for the production of hay and pasture of the mixture of grasses, including Italian Rye Grass and Meadow Fescue, and clovers, which has been widely employed for a number of years with satisfactory results, with a mixture from which Italian Rye Grass and Meadow Fescue were excluded, and an additional quantity of Cocksfoot included instead. The following mixtures of grasses and clovers were sown at each centre:—

I.		II.	
15 lb.	Perennial Rye Grass.	15 lb.	Perennial Rye Grass.
7 ,,	Italian Rye Grass.	3 ,,	Timothy.
4 ,,	Meadow Fescue.	9 ,,	Cocksfoot.
3 ,,	Timothy.	2 ,,	Broad Red Clover.
3 ,,	Cocksfoot.	2 ,,	Late Flowering Red Clover.
2 ,,	Broad Red Clover.	1 ,,	Alsike Clover.
2 ,,	Late Flowering Red Clover.	1 ,,	White Clover.
1 ,,	Alsike Clover.		
1 ,,	White Clover.		

In the season of 1927, when the plots at all centres were mown for hay, slightly better returns were obtained where the mixture containing Italian Rye Grass and Meadow Fescue was sown. During the past season the plots were kept under observation and reports were received from 29 of the 37 centres at which the experiment was originally laid down. At 15 centres the plots were again mown for hay, and at the remaining 14 centres they were grazed in 1928. From eight of the centres where the plots were in pasture it was reported that there was a better sole of grass and a greater abundance of clovers on the plot sown with the mixture from which Italian Rye Grass and Meadow Fescue were omitted than on the corresponding plot sown with the mixture in which both of these grasses were included. At the remaining seven centres there was no noticeable difference in the appearance of the pasture on the different plots.

The yields of hay produced at the fourteen centres where the plots were meadowed in 1928 are shown in detail in the following Table :—

District or County	Soil	Yield per Statute Acre					
		Mixture I.			Mixture II.		
		T.	C.	Q.	T.	C.	Q.
Clare	Medium loam ...	2	2	1	2	4	3
"	Medium loam ...	1	15	1	1	16	1
Dublin	Clay loam	1	7	2	1	11	2
"	Sandy loam ...	0	14	3	0	15	3
Galway S.	Medium loam ...	1	16	0	1	18	0
Kilkenny	Clay loam	1	18	0	2	2	0
Laoighis	Peaty loam ...	1	16	2	1	19	0
"	Peaty loam ...	2	13	0	1	17	0
Mayo S.	Peaty loam ...	1	18	0	2	0	0
Mayo N.	Light loam ...	2	8	0	2	5	0
Meath	Clay loam	1	6	2	1	9	1
"	Clay loam	1	8	3	1	7	2
Tipperary N. ...	Clay loam	2	13	0	2	8	0
Wicklow	Medium loam ...	2	10	0	2	8	0
Average yield per statute acre (14 centres)		1	17	3	1	17	1

The average yield of hay produced in the second season from both mixtures is practically equal.

A series of trials similar to those conducted in 1926 were again laid down at ten centres in the spring of 1927. The yields of hay produced on the plots at each centre in the season of 1928 are shown in detail in the following Table :

[TABLE

District or County	Soil	Yield per Statute Acre					
		Mixture I.			Mixture II.		
		T.	C.	Q.	T.	C.	Q.
Cork N.E.	Medium loam ...	2	9	0	2	7	0
,, ...	Dark loam ...	3	0	0	2	16	0
Cork N.W.	Medium loam ...	1	18	2	2	2	3
,, ...	Rich loam	1	15	3	2	0	3
Kilkenny	Light loam ...	1	12	3	2	2	3
Mayo S.	Medium loam ...	2	10	0	3	1	0
Tipperary N. ...	Rich Clay loam ...	2	18	1	2	6	3
Waterford	Red Sandy loam ...	3	0	0	2	18	1
Wexford	Sandy loam ...	2	15	0	3	5	0
,, ...	Light Clay ...	3	2	0	3	15	0
Average yield per statute acre (10 centres)		2	10	0	2	13	2

Contrary to the results obtained in the previous year the best returns were obtained from the mixture from which Italian Rye Grass and Meadow Fescue were omitted. The experiments were however only conducted at a small number of centres compared with the previous season.

Although the trials have been in progress over two seasons, it is not yet possible to form an opinion as to the relative value for the production of both hay and pasture of the two mixtures. The plots are, however, being kept under observation with the object of comparing the pasture produced on the different plots in subsequent seasons.

II.—ROTATION EXPERIMENTS WITH LIME.

During each of the three seasons 1924, 1925 and 1926, experiments were laid down by Agricultural Instructors with the object of determining the influence of applications of burnt lime and ground limestone over the period of an ordinary rotation. The arrangement of the experiment was as follows :—

Three contiguous plots of one statute rood each were measured off at each centre. One of these plots, which was reserved as a control, received no lime, and the other two were dressed with burnt lime and ground limestone respectively. In the first season's experiments burnt lime was applied at the rate of two tons, and ground limestone at the rate of 4 tons per statute acre. In the subsequent seasons the quantities of burnt lime and ground limestone applied per statute acre were reduced to 1½ tons and 3 tons respectively. Owing to the difficulty of procuring adequate supplies of ground limestone, the full series of plots were laid down at only a limited number of centres. The land selected for the trials each season had not been dressed with lime for a considerable number of years, and at many centres there was no record of lime having been applied at any time. The lime and ground limestone were in each of the three seasons applied to the land prior to the sowing of lea oats.

The results obtained in the first, second, third and fourth seasons from the experiments laid down in 1924 ; the results for the first, second and third seasons from the trials commenced in 1925, and the returns for first and second seasons from the trials inaugurated in 1926 were published in previous reports.*

Reports were obtained during the past season from 17 centres where the experiment was laid down in 1924. At eleven of these centres the plots were in pasture ; in two other cases they were mown for hay, and at the remaining four centres tillage crops were grown on the plots. At six of the centres where the plots were in grass no difference in appearance or in growth could be observed between the pasture on the limed and non-limed plots, while at the remaining five centres an earlier growth and a better development of clovers was noticeable where burnt lime or ground limestone had been applied. From two of the five centres where the full series of plots were laid down, and where a plot dressed with ground limestone was included, it was reported that a somewhat earlier growth developed in Spring on the plot treated with ground limestone than on the corresponding plot dressed with burnt lime. However, at the other centres similar results were produced by both burnt lime and ground limestone.

It was not found possible to secure reliable weighings from the centres where the plots were mown or sown with tillage crops during the past season, except in two cases, and at each of these slightly better returns were obtained where lime had been applied. From three centres it was reported that the crops on all plots presented a similar appearance, while at the remaining centre, where oats was grown, the crop was said to have been better on the limed than on the unlimed plots.

The returns obtained during the fourth year of the rotation from 10 centres where the experiment was laid down in 1925 are shown in detail in Table I. of this report. Better yields were, with two exceptions, obtained where lime or ground limestone had been applied.

The results obtained during the third year of the rotation from 15 centres where the experiment was laid down in 1925 are shown in detail in Table II. of this report. As in similar trials better returns were in general obtained where lime or ground limestone had been applied. The most remarkable feature of this series of trials is the extraordinarily increased yields produced on the plots dressed with burnt lime and ground limestone at two centres in South-east Cork. The soil at these two centres which is described as a sandstone loam appears to be particularly deficient in lime.

The results of these experiments which have been conducted at a number of centres and on a wide variety of soils during the past five years indicate generally that burnt lime and ground limestone are of similar value when used in equivalent quantities, and that when applied to tillage land at the beginning of the rotation they are likely, on most soils, to produce increased yields even in the fifth year of the rotation.

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*Dept's. JOURNAL Vol. XXIV, No. 4 ; Vol. XXV, No. 4 ; Vol. XXVI, No. 4 ; and Vol XXVIII No. 1.

TABLE I.

ROTATION EXPERIMENT WITH LIME LAID DOWN IN 1924. THIRD SEASON'S RETURNS (15 CENTRES).

County	Character of Soil	Crop	Manure applied per statute acre	Yield per statute acre. No Lime		Burnt Lime		Ground Limestone	
				T. C.		T. C.		T. C.	
Mayo	Moory loam	Potatoes ...	Farmyard manure and artificials.	9 18		10 8			
Westmeath ...	Medium loam ...	Potatoes ...	Farmyard manure (12 tons), 5 cwt. special potato manure.	9 7		9 11			
Cavan	Stiff clay	Potatoes ...	Farmyard manure and 3 cwt. special potato manure.	11 0		11 0			
				Grain C. Q.	Straw C. Q.	Grain C. Q.	Straw C. Q.	Grain C. Q.	Straw C. Q.
Kilkenny ...	Medium loam ...	Barley ...	—	17 1	31 0	22 0	35 0	—	—
Cork N.E. ...	Dark loam	Oats ...	—	21 3	30 3	23 2	33 0	23 3	:5 2
Cork S.E. ...	Sandstone loam ...	Oats ...	—	10 3	30 0	24 0	35 0	25 0	38 0
Cork S.E. ...	Medium sandstone loam	Oats ...	—	12 2	14 0	20 0	27 0	21 1	30 0
Donegal ...	Light and poor ...	Oats ...	—	16 3	31 2	18 2	32 0	—	—
Dublin	Clay loam	Oats ...	—	30 1	—	34 0	—	32 0	—
Kildare ...	Grey moor	Oats ...	—	18 1	32 3	18 3	34 2	—	—
Kildare ...	Clay loam	Oats ...	—	18 3	32 3	20 2	35 1	—	—
Mayo	Clay loam	Oats ...	—	19 1	—	20 3	—	—	—
Meath	Moory loam	Oats ...	—	16 2	39 1	17 3	37 3	17 1	41 2
Roscommon ...	Clay loam	Oats ...	—	41 2	—	45 0	—	—	—
Sligo	Wettish boggy loam ...	Oats ...	—	21 1	32 0	24 3	39 2	—	—
Average yield of grain per statute acre (12 centres)				20 2	—	24 0	—	—	—
Average yield of grain from 5 centres where a plot dressed with ground limestone was included				18 2	—	23 3	—	23 3	—

County	Character of Soil	Crop	Manure applied per statute acre	Yield per statute acre. No Lime		Burnt Lime		Ground Limestone	
				T.	C.	T.	C.	T.	C.
Kildare ...	Medium loam ...	Sugar Beet ...	Farmyard manure and Artificials.	9	18 (18·1 per cent. Sugar)	11	6 (18·1 per cent. Sugar)	—	
Mayo	Peaty loam	Potatoes ...	Farmyard manure and a complete mixture of artificials.	11	0	11	10	—	
Mayo	Loam	Swedes ...	Farmyard manure and artificials.	19	16	21	0	—	
Tipperary S. ...	Medium clay ...	Mangels ...	4 cwt. Super 4 ,, Kainit 2 ,, Sulphate of Ammonia	32	10	34	12	32	18
Westmeath ...	Gravelly loam (peaty)...	Swedes ...	10 tons farmyard manure, 4 cwt. super. 1 cwt. Sulphate of Ammonia.	23	3	22	3	—	
Clare	Medium loam ...	Hay (1st crop)		1	18	2	1	2	2
Cork	Peaty loam	Hay (1st crop)	—	1	18	1	19	1	12
Limerick ...	Light loam	Hay (1st crop)	—	2	18	2	10	—	
Meath	Clay loam	Hay (1st crop)	—	1	15	1	16	1	18
				Grain	Straw	Grain	Straw	Grain	Straw
				C. Q.	C.	C. Q.	C.	C. Q.	C.
Donegal ...	Light loam	Oats ...	—	19 3	35	21 0	33	—	—

Whilst better returns have in each season, in almost all cases, been produced where lime had been applied, the increased yields were, with a few exceptions, not very substantial, and it is evident that while the beneficial effects of a dressing of lime may extend over a number of years, no very marked immediate results may be expected from its application. In other words the benefits of lime as a dressing for tillage land may be said to be cumulative rather than immediate.

Although these experiments have been conducted over a number of years and on a great variety of soils ranging from reclaimed mountain and peaty soils to loams and light sandy soils, the results provide practically no guidance as to the types of soil which are most likely to respond quickly to applications of lime. In many instances comparatively little benefit was derived where lime was applied to peaty and recently reclaimed soils, whereas in other cases quite good results were obtained even on loamy soils in good condition overlying limestone. It is, therefore, evident that the requirements of different soils as regards lime can only be satisfactorily determined by actual trial, and farmers who contemplate purchasing lime as a dressing for land would be well advised to arrange, as a preliminary, for the conduct of a trial on a small scale on their own farms.

III.—THE MANURING OF PASTURE.

Phosphates.

During the three seasons 1922-24 a series of demonstrations with various types of phosphatic manures were laid down on pasture land by Assistant Agricultural Overseers at 138 centres in Western counties. In the first season Basic Slag, Peerless and Gafsa Mineral Phosphate were applied. In the two subsequent seasons Algerian mineral phosphate was used in addition at each centre. The manures were in all cases applied at the rate of 8 cwt. per statute acre, and the demonstrations were in general, located on land of the poorer type and which had not been manured for some years previously. In the first season each of the phosphates produced a distinct improvement in the pasture; the best results were, however, obtained from basic slag and Peerless. The plots at the various centres have been kept under observation each year since, and the results have been noted annually in these reports. In the second and third seasons following that in which the manures were applied, results somewhat similar to those produced in the first year were obtained at almost all centres. After the third season it became evident that Peerless was becoming relatively less effective than the other phosphates, and each year since it has given poorer returns, so much so, that in 1928 at about one-third of the centres no benefit whatever from the application of Peerless was noticeable, while at almost all of the remaining centres the returns from this manure were inferior to those produced by the other phosphates. It is,

therefore, evident that while Peerless is capable of producing marked results on pasture in the seasons immediately following application its influence is not lasting. Basic Slag, which continued to produce favourable returns over a much longer period than Peerless, also showed a tendency to become ineffective after the fifth season, and in the last year it has, at the majority of the centres, given a poorer return than the mineral phosphates, while in a few cases it has produced no noticeable benefit. On the other hand both Gafsa and Algerian phosphates, which in the earlier years were not so effective as Peerless or Basic Slag, have, in the later seasons, at most centres, given much better returns than these manures, and it is quite evident that mineral phosphates of the Gafsa and Algerian types are capable of producing an improvement in pasture over a longer period than Basic Slag.

A series of plots dressed with Semsol, Clare phosphate and McDilla mineral phosphate at the rate of 8 cwt. per statute acre were laid down on pasture land by Assistant Agricultural Overseers at a number of centres in Congested Districts in the early Spring of 1926. At about two-thirds of the centres tests were conducted with Semsol and Clare phosphates, while at the remaining centres Clare phosphate and McDilla mineral phosphate were applied to contiguous plots.

In the season in which the manures were applied and in the subsequent season, Semsol proved definitely superior to Clare phosphate at all centres, and in a number of cases no distinct improvement was noticeable where the latter phosphate was applied. In the corresponding seasons McDilla mineral phosphate produced better results than Clare phosphate, except at a very small number of centres.

Reports on the appearance of the plots in the season of 1928 indicate that Semsol, in the third season, continued to produce a marked improvement in the general appearance of the pasture, and at over 90 per cent. of the centres at which plots were laid down, it produced results definitely superior to those obtained where Clare phosphate was applied. McDilla mineral phosphate, whilst not so outstanding in its influence on the pasture as Semsol, was also considerably superior to Clare phosphate at nearly all centres. The latter phosphate again produced unsatisfactory returns, and at about half the centres at which it was applied no particular improvement was noticeable in the general appearance of the pasture on the plots. In a few cases, however, mostly on very peaty soils, the Clare phosphate produced reasonably good returns, and from one centre in County Kerry on a very poor peaty soil, it was reported to have given a better return than Semsol.

A further series of trials on grassland with Semsol, Gafsa mineral phosphate and Clare phosphate were laid down by Assistant Agricultural Overseers in the Spring of 1927. As in the previous trials the manures were applied at the rate of 8 cwt. per statute acre. In the first season, Semsol produced outstanding results at almost all centres. The pasture on the plots dressed with Gafsa did not respond well early in the season to the manuring, but later in the year a considerable improvement was noticeable in almost all cases. The returns from Clare phosphate were quite unsatisfactory; no beneficial benefits being noticeable at fifty per cent. of the centres at which this manure was applied.

In the past season Semsol continued to produce good returns at all centres, the difference between the plots dressed with it and with Gafsa mineral phosphate was, however, not so noticeable as in the previous year, and at a great number of centres, Gafsa produced practically as good results as Semsol. As in the other trials, Clare phosphate failed to produce any appreciable improvement except at a relatively small number of centres on peaty soils.

Phosphates and Lime.

In the early Spring of 1925, a series of trials on grassland with Basic Slag, Semsol, Gafsa Mineral Phosphate, burnt lime and ground limestone, were laid down by Agricultural Instructors at a number of centres throughout the Saorstát. The phosphates were, in all cases, applied at the rate of 6 cwt., the burnt lime at the rate of 1 to 1½ tons, and the ground limestone at the rate of 3 tons per statute acre. As it was not found possible to procure adequate supplies of ground limestone, plots dressed with this material were not included at all centres. A similar series of experiments were again laid down in the Spring of 1926.

In the first and second seasons all the phosphatic manures effected a distinct improvement in the pasture to which they were applied. Gafsa mineral phosphate did not, however, produce as early a growth or as distinct an improvement as Basic Slag or Semsol, the returns from which were about equal. Both burnt lime or ground limestone, except at a very limited number of centres, failed to produce any noticeable benefit.

In the third season Basic Slag continued to produce remarkably good results, while Semsol appeared to be slightly less effective, and Gafsa more effective than in the previous seasons. At about half the centres at which burnt lime or ground limestone were applied, no improvement was noticeable, while at most of the remaining centres the benefits derived from the dressings of lime were small compared with those produced by the phosphates, and it was only in one or two cases that any appreciable improvement was brought about where burnt lime or ground limestone was applied.

Reports received from over 40 centres where trials were laid down in 1925, indicate that during the fourth season Gafsa Mineral Phosphate, at a large number of centres, gave quite as good a return as Basic Slag or Semsol, both of which, particularly Semsol, appeared to be slightly less effective than in the previous year. As in 1927, no improvement was noticeable in the appearance of the pasture on the plots at about half the centres at which burnt lime and ground limestone had been applied. At the remaining centres the herbage on these plots presented a greener and fresher appearance than that on the untreated or control plot, but it was only in four or five cases that any appreciable improvement was apparent as a result of the application of burnt lime or ground limestone. As a result of these trials it is evident that dressings of burnt lime or ground limestone are, on most soils, not capable of producing an improvement in pasture comparable with that likely to be obtained from the use of phosphatic manures.

Phosphates and Potash.

In numerous experiments and demonstrations conducted throughout the country on a variety of soils over a number of years, it has been clearly shown that phosphates are the basis of grassland manuring, and that remarkably good results accrue from the use of even a relatively light dressing of a suitable phosphatic manure on pasture. The influence of potash as a supplement to phosphates on grassland has been tested at a number of centres from time to time, and in general, the results were not such as would encourage the widespread use on pasture of manures containing this ingredient. Since, however, tests with potash on grassland were not carried out at a large number of centres, it was decided last Winter that Instructors should, during the season of 1928, arrange for top dressing trials on pasture with phosphates alone and phosphates supplemented by potash at a number of centres in each county in the Saorstát. Accordingly, each Instructor was asked to conduct tests at four or more centres in his district ; the plots at each centre to be top-dressed completely with a phosphatic manure, one half of each plot so treated being also dressed with Kainit at the rate of 3 cwt. per statute acre. Instructors were not restricted to the use of any particular phosphatic manure, but they were asked to confine their selection to such of these manures as had, in previous trials, given satisfactory returns when applied to grasslands.

Trials were conducted on a wide variety of soils at 463 centres. The phosphatic manures used were Basic Slag at 155 centres, Semsol at 145 centres, Gafsa mineral phosphate at 117 centres, and superphosphate at the remaining 46 centres. These manures were applied at rates varying from 4 to 8 cwt. per statute acre, but at the great majority of the centres 6 cwt. per acre was used. Kainit was, in all cases, applied to one half of the plot already dressed with a phosphatic manure at the rate of 3 cwt. per statute acre.

At almost all centres the pasture on the plots dressed with phosphates alone showed a considerable improvement as regards general appearance, earliness of growth and development of clovers, compared with the control or unmanured portion of the field. The pasture on the portion of the plots where kainit had been applied in addition to phosphates was, at about one-third of the centres at which trials were conducted, said to present a somewhat better appearance and to contain more clovers than that on the corresponding portion of the plot dressed with phosphates only. From no centre, however, was it reported that there was any very distinct or outstanding difference in favour of part of the plot to which both Kainit and phosphates had been applied. At the remaining centres no difference whatever could be observed between the pasture on the area treated with phosphates and that on the part dressed with both phosphates and potash. The centres at which Kainit, when applied as a supplement to a phosphatic manure, gave increased returns were not confined to any particular type of soil. It was noticed, however, that a greater proportion of the centres at which potash produced results were located on peaty and heavy soils rather than on the lighter types of soils. At the small number of centres where phosphates failed to produce any definite improvement in the herbage the addition of Kainit also gave negative results.

The results of these tests are in general agreement with those obtained in similar trials conducted in this country and elsewhere in recent years, and they indicate generally that on most soils very little by way of improvement in the herbage of pasture is likely to be effected in the first season from the use of Kainit, where an adequate quantity of a suitable phosphatic manure has already been applied. The plots are being kept under observation with a view to determining the effects of the dressing of Kainit in the second and subsequent seasons.

THE NEW SYSTEM OF GRASSLAND MANURING AND MANAGEMENT.

In the past couple of years considerable interest has been aroused in a method for increasing the productivity and stock carrying capacity of pastures by the use of repeated applications of nitrogenous manures in addition to a primary or basal dressing of phosphates and potash. The method, which originated in Germany, and which is usually described as the "Hohenheim System" or "The New System of Grassland Management," is a combination of three things: (*a*) complete manuring with relatively large applications of nitrogenous manures, (*b*) rotational grazing of stock, and (*c*) systematic cultural treatment of the pastures.

In the manuring of pastures the general practice was to apply dressings of phosphatic manures, and it has been clearly demonstrated in innumerable trials conducted in this country and elsewhere that considerable improvement both in the bulk and in the quality of the pasture, as indicated by the development of white clover, resulted from applications of these phosphates. Furthermore, it has been shown that such results can be obtained at a relatively small cost.

The use of nitrogenous manures on grassland has, up to very recently, not been favoured, as it was considered that the employment of these fertilisers encouraged the growth of grasses to the detriment of the clovers, and that, as a consequence, the nitrogen content and the nutritive value of pasture as a whole was reduced. In recent investigations into the composition of pasture it has, however, been shown that young leafy grass possesses a very high nitrogen content, and it follows, therefore, that provided the grasses are consumed before they reach a certain stage of maturity, the nutritive value of the pasture is not mainly dependent upon the proportion of white clover present. In the new system the main object is to promote, by the repeated use of manures, mainly nitrogenous, the rapid growth of grass, and to arrange for the grazing off of this young grass in the shortest possible period. To achieve this object it is necessary to arrange for heavy stocking of pastures, and in order to do so it is essential that the grassland should be divided up into a number of small fields or paddocks. As the herbage on each enclosure is eaten off the stock are moved on to the adjoining field and a dressing of nitrogenous manure applied to the grazed area in order to encourage further rapid growth, which in turn is again grazed down.

This system of grassland manuring and management was first tried in the year 1916 by Dr. Warmbold, at the Agricultural College, Hohenheim, Germany, where it was afterwards carried on for a number of years. The results were so satisfactory that the system was extensively adopted by farmers in Germany. Early in 1925, mainly at the instigation of the British Sulphate of Ammonia Federation (now incorporated with Messrs. Nitram, Ltd., in association with Imperial Chemical Industries, Ltd.), experiments on similar lines were commenced at a number of centres in Great Britain. In the Winter of 1926-27 the British Sulphate of Ammonia Federation approached the Department with the object of establishing a trial of the system at one of the Department's Agricultural Stations, and eventually arrangements were made for the starting, early in 1927, of an experiment at the Agricultural Station, Clonakilty. A general report on the experiment at Clonakilty Agricultural Station, which has now been in progress over two seasons, will shortly be published.

Towards the end of 1927 the Department were asked by Messrs. Nitram, Ltd., to allow the Agricultural Instructors to supervise a number of trials on typical farms throughout the Saorstát. In view of the results which had been obtained during the season of 1927 at the Clonakilty centre, the Department came to the conclusion that the system was worthy of further trial and, accordingly, it was agreed that, subject to the approval of the County Agricultural Committee concerned, each Instructor should arrange for the supervision of one experiment in his district, if a suitable farm was available. In order to facilitate the Instructors in the selection of suitable centres and to encourage farmers to undertake the trial, Messrs. Nitram, Ltd., agreed to provide, free of charge, for each trial the necessary nitrogenous manures required for the first year, and one-half of the nitrogenous manures required in the second year of the trial. Messrs. W. & H. M. Goulding, Ltd., also agreed to supply, at half price, for all centres the phosphatic manures required in the first season, and Messrs. The United Potash Co., Ltd., provided, in a number of cases, the potash manures required in the first season at reduced rates. In due course arrangements were made for the establishment of trials at 28 centres in 21 counties. The names and addresses of the farmers with whom the trials were located, and the area under test at each centre are shown in the following table :—

County	Name and address of Plotholder	Area under Experiment
Cavan ...	Mr. H. Sythes, Cavan	18¼ acres.
Clare ...	Mr. P. McInerney, Doonogrogue Castle, Killimer, Ennis	16 ,,
Cork N.E. ...	Mr. J. O'Neill, Skeeheen, Mitchelstown	19 ,,
Cork S.E. ...	Mr. M. Hyde, Tooreen, Innishannon	19 ,,
Cork Mid ...	Mr. J. O'Keeffe, Toames, Macroom	13½ ,,
Cork N.W. ...	Drishane Convent, Millstreet (Mr. C. McCarthy, Steward)	18 ,,
Cork W. ...	Mr. J. O'Sullivan, Rathbarry Farm, Clonakilty ...	16 ,,
Donegal ...	Mr. W. C. Stevenson, Dromore, Letterkenny ...	25 ,,
Dublin ...	Mr. J. J. O'Donoghue, Dardistown, Cloughran ...	22¾ ,,
Galway ...	Mr. J. P. Keane, Coorheen, Loughrea	11 ,,
Galway ...	Mr. T. Costello, Clough, Ballyglunin	6 ,,
Kerry ...	Revd. Bro. Walsh, St. Joseph's Industrial School, Tralee.	12½ ,,
Kildare ...	Mr. S. J. Browne, Ardeein, Naas	25¼ ,,
Laoighis ...	Mr. W. P. Aird, Nut Grove, Portlaoighise ...	10 ,,
Leitrim ...	Mr. J. Regan, Athyfinlay, Carrick-on-Shannon ...	6 ,,
Longford ...	Mr. S. H. Martin, Ardnacassa, Longford	22 ,,
Louth ...	Mr. J. Bellew, Killinear, Drogheda	38 ,,
Limerick ...	Mr. J. Fitzgerald, Toberrea, Kilmallock	17 ,,
Limerick ...	Salesian Fathers, Copsewood College	18 ,,
Mayo ...	Mr. W. Shannon, Cloonagh House, Ballina ...	21 ,,
Monaghan ...	Mr. F. Ruske, Cloncallick, Clones	18 ,,
Offaly ...	Mr. S. Mounsey, Beechill, Tullamore	12 ,,
Roscommon ...	Mr. W. L. Phair, Rampark, Castlerea	23½ ,,
Sligo ...	Mr. J. J. McIntyre, Cloonacool, Tubbercurry, Sligo	16¾ ,,
Tipperary N.R.	Mr. J. Kennedy, Loran Park, Roscrea	15 ,,
Tipperary S.R.	Mr. M. O'Donnell, Marlhill, New Inn, Cahir ...	17½ ,,
Waterford ...	Mr. P. Phelan, Carrowleigh, Rathcormack ...	16 ,,
Wexford ...	Mr. M. Ryan, Coolteen, Barntown	23 ,,

At all centres the area under trial was first divided into a number of fields or paddocks ranging from six to eight in number. In a few cases where the existing fields were of a suitable size no subdivision was required. At most centres, however, it was necessary to divide up the land into suitably sized plots or paddocks by the erection of wire fences. Except at a few centres where adequate supplies of drinking water were available, special arrangements had to be made for the provision of a supply for the stock grazing on the plots. In many cases this difficulty was got over by so arranging the fences and gates that the animals grazing on any plot would have access to a central supply, and in this way, the expense of laying on water to each plot was avoided.

In the Winter or early Spring the area under the trial received a dressing of phosphates and potash. Where, however, either of these manures had been applied during the previous year the dressing was not repeated. The same type of phosphatic or potassic manure was not used at all centres and the quantity of each manure applied varied according to the condition of the land. In most cases, however, about 4 cwt. superphosphate or its equivalent in the form of some other phosphatic manure, and 2 to 3 cwt. Kainit or its equivalent in Potash manure salts, were applied per statute acre. Towards the end of February or early in March a dressing of sulphate of ammonia at the rate of about 1 cwt. per statute acre was applied to the first plot, and subsequently, at regular intervals of about a week, each of the other

plots received a similar dressing. Two similar applications of sulphate of ammonia were in most cases given to the plots later in the season, one towards the beginning of Summer and the other in late Summer or Autumn.

At nearly all centres the first plots were fit for grazing from a fortnight to three weeks earlier than general grazing was possible in the districts in which the various trials were located. In the majority of cases the plots were grazed first by dairy cows, beginning with the plot which had received the dressing of nitrogen first. In the course of a week or so, and when the grass had been well bared down, the cows were moved on to the next plot and store cattle, dry cows, sheep or horses were turned on to the first plot to graze down any herbage which had remained uneaten by the dairy cows. When the latter were moved on to the third plot the other stock or "followers" were transferred to the second plot, and this sequence was followed throughout the grazing season. As soon as a plot was grazed down bare and when all stock had been moved on to the next plot, it was well harrowed to distribute the droppings and thus prevent patchy growth. The second dressing of sulphate of ammonia was then applied, and by the time the last of the plots was grazed down the first plot was again ready for grazing by the dairy cows.

The other plots were similarly treated, and the third dressing of sulphate of ammonia was applied in the same manner later in the season. The actual length of time required to complete the cycle of the plots varied at the different centres according to the nature of the soil, the rate of growth of the herbage, and the numbers and type of stock grazed on the plots. In a few cases it was found that at the flush of the growing season the numbers of stock available were not capable of keeping the plots grazed down with the result that the herbage showed a tendency to "get ahead" of the stock. At these centres one of the plots was set aside for hay, and with the reduced number of plots it was found that the stock were able to consume the grass before it got too advanced in growth. Later in the season, when growth was not so rapid, and after the hay had been removed, the plot which was meadowed was again grazed in the same manner as the other plots.

At all centres accurate records were kept of the quantities of manures applied and the dates of application, the numbers and types of stock grazed on each plot throughout the season and the amount of milk produced where dairy cows were pastured on the plots. Particulars are also available as to the stock carrying capacity in the previous years of the land under treatment, and it is, therefore, possible to estimate fairly accurately the benefits which have accrued from the adoption of the system at each centre. Detailed reports on these trials have already been published in the Annual Reports issued by the County Committees of Agriculture, and farmers or others who are interested in the trials are recommended to apply to the Secretary of their local Committee for a copy of the Annual Report.

While it is not possible as a result of one season's trials to form a definite opinion as to the economy of the system and the likelihood of its general adoption in this country, it is quite evident that the main principle of the system, that is, the use of successive applications of nitrogenous manures in addition to a primary dressing of phosphates and potash, is a sound one

and that by its adopcion a considerable increase in production can be obtained. It is also evident that the proper handling of the grazing stock or the adoption of a system of rotational grazing is a factor almost equally important as the manuring of the land.

On farms where the fields are relatively small and where each field, division or paddock already has a water supply adequate for the needs of the stock grazed on it, or where such supply can be readily or inexpensively provided, the establishment of the system presents little difficulty, and the expenditure is largely confined to the cost of the manures. Where, however, the land would have to be divided up into smaller areas and where the laying on of water would be expensive, the initial expenditure may prove to be such as to deter farmers from giving the new method a trial. As the system in this country has not yet passed the experimental stage there are many points, such as the number of plots or divisions, the quantity of manure to apply, and the time of application, in regard to which further information is required before definite recommendations regarding the conduct of system can be made. In general, however, more particularly on farms where a shortage of fodder occurs in late Spring, it will be found that the application of a light dressing of a nitrogenous manure early in Spring as a supplement to phosphates and potash will prove extremely valuable in encouraging an early growth of grass at a season when foods are expensive and when the milk supply of dairy cows tends to fall off. Moreover, the general practice of regular or rotational grazing of pastures is one which is well worthy of trial even on farms where nitrogenous manures are not regularly used on grassland.

It should be clearly borne in mind, however, that the results from the trials with this "new system" of grassland management in no way detract from the importance of phosphates in the manuring of pasture. The application of a suitable dressing of phosphatic manures is a necessary preliminary to the improvement of pasture land.

SEED-TESTING.

(*The following talk of a popular nature, and specially intended for farmers was broadcast from Dublin* (2 *R.N.*) *on* 18*th Feb.*, 1929, *by* H. A. Lafferty, F.R.C.Sc.I., *Head of the Seed Testing Station, Department of Agriculture, Dublin*).

World-wide competition in agricultural production has developed to such an extent in the past few years that the Irish farmer must, as far as possible, eliminate every element of chance in farm practice if he is to strengthen his position in the struggle that is going on. Haphazard methods were pardonable to a certain extent in days gone by, when, if the price of agricultural produce was low, it was at least accompanied by a correspondingly low cost of production. To-day, however, a completely different set of conditions exist, and while prices are higher on the whole than those which ruled formerly, profits are, nevertheless, swallowed up by abnormally high cost of production. One solution to this problem in agricultural economics seems to stand out, namely, increased production, and in this connection I particularly want to emphasize increased crop production per unit area, for on this depends possibilities for expansion in the other branches of farm practice. If we accept this as a solution and proceed to examine the question more closely, we will, sooner or later, find ourselves faced with the problem of "quality" in agricultural seeds. This is not a new problem. It existed from earliest times and continued to remain unsolved until the sixties of the last century. From that time onward, however, Agricultural Science, especially that branch of the subject which dealt with Seed-testing, advanced to such an extent that farmers are now in the fortunate position of being able to learn a great deal about the seeds which they propose to sow.

The year 1867 marked the birth of practical Seed Testing, for in that year the first Station was opened for the testing of Agricultural seeds. This was in Saxony.

During the next few years a great impetus was given to Seed Testing, and stations under Government control were instituted for the testing of agricultural seeds in Hungary in 1871, in Switzerland in 1875, in Austria in 1881, in Germany in 1891, and in Holland in 1894.

It was not until the year 1900, however, that the matter was taken up in the British Isles. In June of that year a Departmental Committee was appointed by the Board of Agriculture in England to enquire into the conditions of the seed trade generally. After hearing much evidence, this Committee recommended that a Seed Testing Station under Government auspices should be established for the United Kingdom. This recommendation was not acted on, but in December of that year (1900) the Department of Agriculture and Technical Instruction for Ireland established in Dublin the first official Seed Testing Station in the British Isles.

Prior to 1900, the farmer, and for that matter his seed merchant, knew very little indeed about quality in seeds, and for the purpose of this address I shall deal with quality as something depending on purity and germination only. They had no scientific methods of judging seed and had to rely on whatever could be learned from its general appearance, its smell or even its

taste. Such rough and ready tests, though perhaps helpful as indications, especially in the case of very inferior seeds, were useless for comparative purposes. Quality in seeds is something that can only be determined by having them tested, and this can best be done in a recognised Seed Testing Station where the highly technical operations involved are carried out by a staff of trained analysts.

At the outset it must be clearly understood that a good sample of seed should contain the largest possible quantity of the seeds of the plant desired to be grown, and that it should be free from seeds of undesirable plants and injurious weeds, as well as from such useless matter as chaff, soil, and other *debris*. In other words, it should have a high percentage of purity. Furthermore, it should be capable of vigorous growth, which means that it should have a high percentage of germination.

How are these tests for purity and germination carried out? In the first place, the sample as received from the farmer or merchant, is turned out on a clean smooth surface and thoroughly mixed, and from the mixed bulk a small quantity is removed and carefully weighed. This small portion is then examined, seed by seed, and all normal seeds of the desired species are put on one side, to be used later for the germination test, while all the impurities, whether they be other crop seeds, weed seeds, chaff, etc., are placed in a separate lot and weighed. Then, by means of a simple calculation, the percentage purity by weight of the sample is determined.

Knowing the purity of the sample in question, the next step is to determine its germination or growth capacity, and for this purpose we use only the pure seeds that remain after the impurities have been removed. Lots of 500 or 900 seeds, depending on the variety in question, are placed in specially constructed germinators, and allowed to remain there for definite lengths of time. These germinators are so regulated that the three factors necessary for germination, namely, moisture, air and heat, are suitably maintained.

Soon after the seeds have been placed in the germinators growth begins, and each mature and living seed produces a little plant or seedling. At regular intervals these seedlings are removed from the germinators and a record kept of the numbers which have developed. This goes on for a definite length of time, depending on the variety of seed in test, and then the final count of seedlings is made and the percentage of germination is determined.

Many farmers, and indeed many seed merchants, seem to be of the opinion that the germination of a sample of seed is all that matters, and if the germination is high, they consider that that in itself should more than compensate for a low purity result, but as we shall see, such an opinion is entirely erroneous.

I have already pointed out that impurities may consist of other crop seeds, weed-seeds, chaff, etc., but for the moment I will confine my remarks to the weed seeds only. Weeds are one of the farmer's greatest enemies, and a constant warfare should be waged against them as they take up valuable space and rob the legitimate crops of food, air and light. Now, weeds do not spring up from nothing. They arise from pre-existing weed seeds, and in nature these seeds reach the land in various ways. Some are carried long distances by wind as, for instance, the "seeds" of the common thistle and

dandelion; others such as the "seeds" of "Robin-run-the-hedge" are carried on the coats of animals, and others still are distributed by means of farmyard manure or farm machinery, but by far the commonest method of weed seed distribution is through the agency of contaminated agricultural seeds which are used for sowing purposes.

A difference of one per cent. in the germination of two samples of seed is for all practical purposes negligible, but when considered with regard to purity, and especially if due to the presence of weed seeds, one per cent., or even fractions of one per cent., may be of extreme importance. It has been calculated, for instance, that in a sample of seed oats 0·1 per cent. by weight of charlock seeds will amount to, approximately, 200 charlock seeds per lb. of oats.

In view of this let us now consider the case of a farmer who sows seed oats having a germination capacity of, say, 98 per cent., purity 99·9 per cent., but the remaining 0·1 per cent. is made up of charlock seeds. If we only look at the germination and purity figures without considering the nature of the impurities we would immediately declare this to be a first class sample of seed. But is it? If we assume that the oats are sown at the usual seeding rate of 18 stones per statute acre, we will find that in doing so charlock seeds have been sown at the rate of 10 seeds per square yard. Just imagine the appearance of an oat crop which at harvest contained 10 charlock plants per square yard—such a state of affairs would spell ruination for the crop and all because the seed contained what appeared to be a negligible amount, that is, one part in one thousand by weight of charlock seeds. The loss of a crop such as I have just referred to is very serious in itself, but when we couple with that the fact that weeds like charlock leave a legacy in the land in the form of their seeds, which in turn will germinate and produce a further crop of weeds, we can realise the great loss both in time and money that must eventually occur in getting rid of weeds which should never have got into the land.

We pride ourselves on our grass lands, but when we do, we subconsciously think of the fattening lands of Meath and a few other counties which have been in grass for generations. If we make a close examination at this time of the year of the pastures in some of the other counties in Ireland, we will find very little indeed to be enthusiastic about. There we will see weeds of all descriptions, and in this connection I am not referring to such weeds as thistles, ragweed, etc., which may effectively be destroyed by cutting, but to such small and persistent weeds as plantain, daisy, dandelion, dock, silverweed, etc., all of which are useless to the farmer for the production of either meat or milk.

Many of our pastures, especially our rotation pastures, are only carrying a fraction of their possible stock-carrying capacity, and this, in my opinion, is largely the result of sowing cheap and inferior seeds which have a low germination and a high weed seed content, and as a consequence the weeds have gained the upper hand in the struggle for supremacy.

Prior to the year 1910 enormous quantities of very inferior, and in many cases worthless or positively harmful, seeds were offered for sale in this country. Much of this material, which consisted of the cleanings from clover seed, undoubtedly came from abroad, but large quantities of what were known

as White Hayseed and Brown Hayseed—in reality the sweepings from hay barns—originated at home, and being cheap, found a ready market, especially in the poorer parts of the country. The following details will show the worthless nature of some of these so-called agricultural seeds.

A sample of seed purchased as White Clover was found on being tested, to contain 21 per cent. of White Clover seeds; 32 per cent. of seeds of grasses, which could be considered useful: and the remaining 47 per cent. of the sample was almost entirely made up of weed seeds, which comprised 21 different species of plants. If we assume that this seed was sown at the rate of 2 lbs. per statute acre, the usual seed rate for white clover, we will find that, approximately, 100 weed seeds were sown on each square yard.

The second illustration is of a sample of White Hayseed which had a germination of 1 per cent. and a purity of 58 per cent., and was purchased at 3s. 6d. per stone. If we apply to this sample the simple calculation of "relative worth" without taking into account its enormous weed seed content, which would greatly decrease its value, we will find that this mixture cost the purchasing farmer the enormous price of 43s. per lb. of pure germinating seed, and that in a year when first grade Ryegrass seed could be obtained for 9d. per lb. And yet farmers were at a loss to know why Hay crops were light and grazing poor.

Having dealt at some length with the conditions of the Irish seed trade in the past, it would be unfair to conclude my remarks without a brief reference to present day conditions, and in this connection it must be said that the Irish Seed Cleaners and Seed merchants generally have co-operated with the Department of Agriculture and with the Department's Seed Testing Station in their endeavour to market a high grade article. To such an extent have their efforts been successful, that I have no hesitation in saying that the Irish farmer of to-day, even in the most backward part of the country, can sow his land with the best seeds in the world provided he takes full advantage of the service which the Seed Testing Station offers. By consulting the purity figures obtained there, he can see at a glance what proportion of the bulk is seed of the kind he requires. He can also see the nature of the impurities, and especially, the amount of weed seeds present; while the germination figure will show him the percentage of the pure seed which is alive and capable of growth.

To those farmers who are listening to me to-night I would say now is the time to act. Place your seed orders at once and get the pick of this season's seed. Avoid seeds which have only cheapness to recommend them, as cheapness and inferiority generally go hand in hand. Insist on being informed of the purity and germination of the seeds which you propose to buy, and only consider those of high quality. On receipt of the bulk of seed, send a representative sample to the Seed Testing Station for test. This will cost you the nominal fee of 3d. per sample, which is an extremely low premium to pay in a highly attractive scheme of crop insurance. You are even relieved from paying postage, as the Department of Agriculture will supply seed envelopes in which samples of seed may be forwarded post free.

Lastly, I would impress on you the fact that our motto in the Seed Testing Station is "first in first served."

REPORT ON THE WORK OF THE SEED PROPAGATION DIVISION FOR 1927.

The rainfall for December, 1926, was the lowest ever recorded for that month, and, as a result, ploughing was, in most districts, well advanced by the end of the year. The weather during the months of January and February was mild, the rainfall being about normal. Towards the end of the latter month when farmers in the earlier districts were making preparations for sowing, the weather broke and the wet period which ensued extended throughout the month of March and interfered with sowing except at a few centres on the lighter types of soils. April was, therefore, well advanced before the bulk of the crop was sown. The wet sunless summer which followed retarded growth and delayed ripening; the harvest being fully two weeks later than usual. The slow ripening, however, favoured the filling of the grain. Crops, though not badly lodged, were, in many cases, twisted and tangled, with the result that harvesting operations were laborious and prolonged.

Threshing operations were, in general, carried out under favourable conditions, and the yield of grain in most districts turned out much better than was expected. The quality of the grain was also good, although many samples were discoloured as a result of the prolonged period of harvesting.

BARLEY.

I.—Propagations.

With the object of ensuring that stocks of pedigree seed barley would be free from smut (H. Ustilago) it was decided that all seed used for propagations at the Plant Breeding Station at Ballinacurra should be subjected to treatment with Formalin in water previous to sowing. The treatment did not appear to influence the germinating capacity of the seed and the resulting crops were apparently free from smut.

(i.) *Pure Line Propagations and Hybrids.*

(*a*) In the cage at Ballinacurra, fifty-four single plant cultivations comprising selections from all the well known varieties in general cultivation, together with a number of selections from new hybrids and from native Donegal varieties were grown.

In the cage at the Albert Agricultural College, University College, Dublin, there were forty-three single plant cultivations, including eight selections from new hybrids as well as several other selections, some of the latter being the same as those grown in the cage at Ballinacurra.

(*b*) Twenty-nine garden plots at Ballinacurra and six at Glasnevin were sown with varieties and selections which it is proposed to bring into further cultivation for propagation and trial.

(*c*) At Ballinacurra ten field plots were sown with varieties required for propagation and large scale experiments in 1928.

(ii.) *1st Pedigree Propagations.*

A plot of Spratt-Archer 37/6 was grown on the farm of Mr. C. Deasy, Loughatalia, Ballinacurra, and plots of Spratt-Archer 37/9, Spratt-Archer 37 No. 3, Spratt-Archer 37 No. 4, Spratt-Archer 37/22, and Spratt-Archer 37/17/52 were grown on the farm of Mrs. O'Brien, Loughatalia.

(iii.) *2nd Pedigree Propagations.*

Plots of Spratt-Archer 37/6 were grown at the following centres :—

Mrs. Tait, Hermitage, Rostellan, Co. Cork ...	... 19	acres.
Mr. Wm. Tait, Buckstown, Rostellan, Co. Cork	... 19	,,
Mr. H. Smith, The Glebe, Inch, Whitegate, Co. Cork	... 10	,,
Mrs. James Tracey, Carrigatogher, Midleton, Co. Cork	... 5	,,
Total	... 53	acres.

(iv.) *Produce of 2nd Pedigree—County Extension Plots.*

Details of the Department's Barley Propagation Scheme were given in the reports on the work of the Seed Propagation Division for 1925/1926 which were published in the Department's Journal, Vol. 25, No. 4, and Vol. 26, No. 4. The scheme was again continued on similar lines in 1927, the amount of seed of the variety Spratt-Archer 37/6 distributed being 384 barrels 7 sts. The names and addresses of the growers, and the quantity of seed supplied in each case, are as follows :—

	Brls.	Sts.
P. J. Roche & Sons, New Ross, Co. Wexford ...	10	0
,, Enniscorthy, Co. Wexford ...	10	0
J. & A. Tarleton, Tullamore	25	0
Minch, Norton & Co., Athy, Co. Kildare	50	0
Joshua Watson & Co., Carlow	10	0
,, Leighlinbridge (Bagenalstown) ...	10	0
W. J. O'Keefe, Faythe Maltings, Wexford	15	0
Deasy & Co., The Brewery, Clonakilty, Co. Cork ...	4	4
Patrick O'Brien, Burtown, Athy, Co. Kildare	1	0
J. P. Kearney, Willville, Carlingford, Co. Louth ...	40	0
A. Odlum, Portarlington	7	0
Thos. Wall, Ballintowtas, Midleton, Co. Cork	5	10
Rd. Hawkins, Whitegate, Co. Cork	15	0
J. Smyth, Rochemount, Whitegate, Co. Cork	14	8
T. O'Brien, Hermitage, Rostellan, Co. Cork	10	0
Wm. Smyth, Finure, Whitegate, Co. Cork	14	8
Rd. O'Keeffe, Ardra, Rostellan, Co. Cork	7	0
Patk. Ahern, Ballinatray, Whitegate, Co. Cork ...	7	0

	Brls.	Sts.
J. Donovan, Whiterock, Midleton, Co. Cork	5	8
Mrs. J. Hegarty, Ballinbeg, Rostellan, Co. Cork ...	24	0
James Simpson, Ballymaloe, Cloyne, Co. Cork	6	0
Wm. McAuliffe, Carrigatogher, Midleton, Co. Cork ...	6	0
Thos. Morrissey, Ballinookera, Whitegate, Co. Cork ...	3	5
Cors. Fitzgerald, Haymount, Midleton, Co. Cork ...	9	0
Thos. Twomey, Ballintubber, Carrigtwohill, Co. Cork ...	3	8
E. P. Higgins, Ardra, Rostellan, Co. Cork	15	0
Ml. Kelleher, Coppingerstown, Ballinacurra, Co. Cork ...	6	4
J. Leahy, Innegrega, Midleton, Co. Cork	4	11
P. Finn, Ballintowtas, Midleton, Co. Cork	6	3
Rd. Smyth, Ballyfin, Cloyne, Co. Cork	12	0
Patk. Wall, Loughcarrig, Ballinacurra, Co. Cork ...	6	0
Nath. Kenneffick, Ballycattoo, Cloyne, Co. Cork ...	8	0
Wm. H. Forde, Castle Redmond, Ballinacurra, Co. Cork	7	6
Total	384	7

It will be observed that a large quantity of the seed was supplied to individual farmers, as Maltsters did not require a large proportion of the seed available for distribution last season.

The resulting crops were, as in previous years, inspected when growing and reported upon as to their probable suitability for seed purposes. In nearly all cases it was found that the crops, if properly saved, should provide seed for the following season. The seed, when suitable, was eventually reserved for seed purposes and sold to growers in the districts in which the plots were located.

(v.) *July Six-rowed Barley.*

In 1926 a garden plot of a variety known as July six-rowed was grown at Ballinacurra, the seed of which was obtained from Copenhagen. In that season it ripened very early and produced seed of good appearance and quality which, when malted, gave promising returns. In the past season a plot of about three-quarters statute acre was sown with this variety at Ballinacurra. It grew freely and ripened early, being harvested on July 28th, and produced a yield of approximately 12 barrels per statute acre. Further trials with this variety are being conducted, and if it continues to yield well, it is possible that it may be suitable for cultivation in districts where the better known varieties do not ripen in good season.

II.—Large Scale Variety Experiments.

These were conducted at ten centres :—Four in Co. Wexford, and one each in Offaly, Louth, Kildare, Laoighis, Tipperary, and Cork. Spratt-Archer 37/6 and Spratt-Archer 37 No. 4 were sown in statute acre plots at all centres; Spratt-Archer 37 No. 3, Spratt-Archer 37/17/52, and Spratt-Archer 37/9 were sown at all centres in plots half a statute acre in size; Spratt-Archer

37/22 was included at eight of the ten centres in plots of similar area, and Old Irish was sown at one of the centres in Co. Wexford, the area of the plot sown with this variety being eleven-twelfths of a statute acre. The seed for all plots was supplied from the Department's pedigree stocks at Ballinacurra.

In Table I. the names and addresses of the plotholders at each centre, a description of the soil on which the plots were laid down, the previous cropping, and the dates of sowing and harvesting are set out.

In Table II. are shown the yield of dressed grain per statute acre, the value per barrel of the grain, and the total value of the grain, including screenings, which were valued throughout at 10s. per barrel, from all plots, with the exception of one plot of Spratt-Archer 37/9 at one of the County Wexford centres which was unfavourably situated and the returns from which have not been included in this report.

TABLE I.

Large Scale Variety Experiments.

Centre	Name and Address of Grower.	Description of Soil.	Previous Crop.	Date of Sowing.	Date of Harvesting
1	Mrs. Tait, Hermitage, Rostellan, Co. Cork.	Loam ... Sub-soil Gravel	Oats, '25 Mangolds, '26	March 31st	August 27th
2	W. Watkins, Coolnagrower, Birr, Offaly.	Light Loam ... Sub-soil Gravel	Oats, '25 Roots, '26	April 14th	Sept. 5th-6th
3	H. Burke, Kilmacoe Lodge, Curracloe, Wexford.	Sandy Loam ... Sub-soil Gravel	Oats, '25	April 20th	Sept 2nd-6th
4	W. J. Waller, Prior Park, Nenagh, Co. Tipperary.	Light Loam ... Sub-soil Gravel	Oats, '25 Turnips, '26	April 14th	Sept 1st-2nd
5	J. P. Kearney, Willville, Carlingford, Co. Louth.	Deep Loam ... Sub-soil Gravel	Oats, '25 Potatoes, '26	April 8th	Sept 1st-2nd
6	N. Howlett, Ramsgrange, Co. Wexford.	Stiff Loam ... Sub-soil Gravel	Oats, '25 Roots, '26	April 18th	Sept 2nd-5th
7	M. P. Minch, Rockfield, Athy, Co. Kildare.	Deep Loam ... Sub-soil Gravel	Grass, '25 Barley, '26	April 11th	Aug. 29th-Sept. 1st
8	P. Byrne, Ballygrangans, Kilmore, Co. Wexford.	Sandy Loam ... Sub-soil Gravel	Oats, '25 Turnips, '26	April 18th and 19th	August 25th-26th
9	T. Furlong, Knockreigh, Adamstown, Co. Wexford.	Deep Loam ... Sub-soil Gravel	Grass, '25 Turnips, '26	April 13th	Aug. 29th-Sept. 3rd
10	A. E. Smyth, Raheen, Ballybrophy, Leix.	Stiff Loam ... Sub-soil Limestone.	Oats, '24 Grass, '25 Grass, '26	April 15th	Sept. 1st-2nd

Of the four varieties which were grown at all ten centres Spratt-Archer 37 No. 3 produced the heaviest average yields. A slightly better monetary result was, however, obtained from Spratt-Archer 37 No. 4. In this respect, however, the difference between these two varieties was extremely small, but at five centres the samples of grain of the latter variety were valued at a higher rate than those of the former, and at four of the remaining five centres samples of both varieties were judged to be of the same value. It would, therefore, appear that Spratt-Archer 37 No. 4 usually produces grain of better appearance than Spratt-Archer 37 No. 3. The standard variety Spratt-Archer 37/6 was slightly inferior in yielding capacity to both Spratt-Archer 37 No. 3 and Spratt-Archer 37 No. 4, but judged by appearance, the quality of the grain was equal to that produced by the latter variety and superior to that of Spratt-Archer 37 No. 3.

Spratt-Archer 37/17/52, a new selection which in the small scale trials conducted in 1925 and 1926 gave promising returns, proved inferior in yielding capacity to the other varieties included in the experiment, with the exception of the variety Spratt-Archer 37/22, but as regards quality of the grain it was on the average superior to all the other varieties tested.

Spratt-Archer 37/22, a selection which has a somewhat different habit of growth from the other types of Spratt-Archer included in these trials and which produces comparatively weak straw, proved inferior in yielding capacity to each of the other varieties included in the trials.

Spratt-Archer 37/9, which produced the highest average yield in the previous season's trials, has been found to be unsatisfactory for malting purposes, and, as in these trials, it has not maintained its heavy yielding capacity, its further cultivation is not recommended.

The seed of the Old Irish variety sown at one centre in County Wexford was the produce of a single plant selected in 1923 and grown successively at Ballinacurra. The crop grew vigorously, but, as in the case of the other varieties at this centre, it lodged badly before harvest. However, it produced a heavier yield of grain than any of the other varieties sown at this centre, but the grain was of a coarse nature and not of good malting quality.

III.—Small Scale Quantitative Experiments.

An experiment with six varieties was laid down at Ballinacurra in the open field and duplicated on a similar scale in the cage. In the field experiment the crop on all the plots lodged badly, so that it was impossible to procure reliable weighings of the produce. Samples of the grain from each variety were, however, obtained for small scale malting tests. In the cage, the crop was attacked by wire worms and other insects, but owing to the large number of replications,—twenty-four of each variety,—the results as shown in Table III. may be considered reasonably reliable.

An experiment in the open field with a different set of varieties was also laid down at the Albert Agricultural College, Glasnevin, but the crop on all the plots lodged to such an extent that no reliable results could be obtained.

TABLE III.

SMALL SCALE QUANTITATIVE EXPERIMENTS. BALLINACURRA, 1927.

—	Total Yield in Grammes.	Average Yield per Plot in Grammes.
Spratt-Archer 37/6	3958·38	164·93
Spratt-Archer 37/6 x G.S. 18/1/1 ...	3718·63	154·94
Abed Rex x Spratt-Archer 37/18/1/1 ...	3583·76	149·32
Spratt-Archer 37/22/36	3518·96	146·62
Spratt-Archer 37/6 x G.S. 18/1/5 ...	3467·12	144·46
A.G. 4/5/1 x Spratt 4	3451·76	143·82

As a result of these experiments it is evident that none of the new selections included, with the possible exception of Spratt-Archer 37/6 x G.S. 18/1/1, are worthy of further trials.

(iv.) *Half Drill Strip Experiments.*

The method employed in the carrying out of these experiments was described in detail in the Report on the work of the Seed Propagation Division for 1924 published in the Department's Journal, Vol. 25 No. 4. Two experiments were conducted in 1927 at Ballinacurra Cereal Station. In the first experiment a hitherto promising wide eared selection from a crossing of Archer-Goldthorpe 4/5/1 x Goldthorpe Spratt 18/1 was tested against Spratt-Archer 37/6. In the second experiment a selection known as A.G.S. 3/3/3 was tested against Spratt-Archer 37/6. The results from both series of experiments are set out in Table IV. where the yields of grain produced on the contiguous strips are shown opposite to each other.

TABLE IV.

Series I.						Series II.					
Strip.	A.G. 4/5/1 x G.S. 18/1		Strip.	S.A. 37/6.		Strip.	A.G.S. 3/3/3.		Strip.	S.A. 37 6.	
	sts.	lbs.		sts.	lbs.		sts.	lbs.		sts.	lbs.
B	2	9	a	3	3	B	3	2½	a	2	12¼
b	2	8½	C	2	13½	b	2	13	C	2	12¾
D	2	5½	c	3	0	D	3	1½	c	3	2
d	3	0	E	2	8¼	d	3	2¾	E	3	0½
F	2	10½	e	2	13½	F	3	4	e	3	2¼
f	2	8¼	G	3	2¼	f	3	2	G	3	0¾
H	2	4¾	g	3	1½	H	3	2	g	2	12½
h	2	11	I	3	4½	h	3	2¼	I	3	0½
J	2	11¾	i	3	5	J	3	0½	i	2	11¼
j	2	11½	K	3	2	j	2	12	K	2	9
L	2	9¾	k	3	3½	L	3	2½	k	2	13¼
l	2	11¾	M	3	4¼	l	3	3	M	3	1
N	2	10¼	m	3	6	N	3	.2	m	2	13½
n	2	12	P	3	4½	n	3	1½	P	2	13¼
Q	2	13¼	p	3	4¾	Q	3	2	p	2	13
q	2	13	R	3	1¼	q	3	0¾	R	3	1½
S	3	1¼	r	3	4¾	S	3	2¼	r	2	13¼
s	3	2¾	T	3	3½	s	3	3	T	2	13¼
V	3	1	t	3	2¼	V	3	0½	t	2	12¼
v	2	13½	W	3	5¾	v	2	13	W	2	10½
X	2	6	w	3	5¼	X	3	0¾	w	3	0
x	2	7½	Y	3	4	x	3	2	Y	3	3
Total	61	0¾		70	5¼		68	5¾		65	3½
Average	2	10¾		3	2¾		3	1½		2	13½

From these experiments it is evident that Archer-Goldthorpe 4/5/1 x Goldthorpe-Spratt 18/1 is inferior, and A.G.S. 3/3/3 superior, in yielding capacity to the standard variety Spratt-Archer 37/6.

V.—Experiment with Barley of the Same Stock but of Varying Nitrogen Content.

This experiment was conducted with a view to determining whether there is any relation between the composition of seed grain (especially in regard to its nitrogen content) and the yield and quality of its resultant produce.

A pedigree stock of Spratt-Archer 37/9 which was grown at Ballinacurra in 1925 was again grown in 1926 at two centres, one in Offaly and the other in County Wexford. At the former centre the grain produced in 1926 contained 1·69 per cent. of nitrogen, and at the latter the nitrogen content was 1·34 per cent. The produce of these two lots was grown in quantitative experimental plots at two centres in 1927 at Ballinacurra, Co. Cork, and at Athy, Co. Kildare, and the results are shown in Table V.

TABLE V.

—	Half Statute Acre Plots.													
	Produce of High Nitrogen Seed.							Produce of Low Nitrogen Seed.						
	brls.	sts.	lbs.	Value of grain per brl.	£	s.	d.	brls.	sts.	lbs.	Value of grain per brl.	£	s.	d.
M. P. Minch, Athy	4	9	13	19/3	4	9	7	5	2	8	19/3	4	19	4
Mrs. O'Brien, Ballinacurra ...	4	12	13	20/-	4	16	2	5	10	2	20/-	5	12	8
Total ...	9	6	12	—	9	5	9	10	12	10	—	10	12	0
Average ...	4	11	6	—	4	12	10	5	6	5	—	5	6	0

These results are not in agreement with those obtained in the similar experiments conducted during the two previous seasons; the yield of grain from the High Nitrogen plots being lower than the yield from Low Nitrogen plots. The value of the grain per barrel was, however, the same, which indicates that the quality of the grain produced is not necessarily affected by the nitrogen content of the seed sown.

Arrangements have been made for the conduct during the season 1928 of further experiments in this connection, and in order to provide suitable seed two quarter acre plots of pedigree Spratt-Archer 37/6 were sown on the farm of Mrs. O'Brien, Loughatalia, Ballinacurra, in 1927, one of which was treated with a large dressing of nitrogenous manure, while the other was left untreated.

On analysis of the grain after threshing, it was found that the produce of the plot dressed with a nitrogenous manure contained 1·73 per cent. of nitrogen, while the produce of the untreated plot contained only 1·39 per cent. of nitrogen.

VI.—Experiments in the Use of Formalin, Copper Carbonate Powder, Copper Carbonate and Mercuric Chloride, Germisan, and Abavit Powder as Preventives of Smut and Stripe Disease.

This experiment which was again conducted at Ballinacurra consisted of twenty-two plots, each of, approximately, 1/10 statute acre arranged in two duplicate series of eleven plots each.

The seed used for the experiment was highly infected with the spores of covered smut (Ustilago Hordei) and the spores were in an active and virile condition; that this was so can be seen from the number of smutted plants produced in the untreated plots.

Four of the plots were sown with untreated seed to act as controls, and were placed at as nearly equal intervals as possible.

The treatments were as follows:—

Nos. 1, 8, 15 and 22 Untreated.

Nos. 2 and 12 ... Seed steeped in 1/240 Formaldehyde solution for 20 minutes, drained, covered for 4 hours and dried.

Nos. 3 and 13 ... Seed steeped in 1/320 Formaldehyde solution for 20 minutes, drained, covered for 4 hours and dried.

Nos. 4 and 14 ... Seed steeped in 1/480 Formaldehyde solution for 20 minutes, drained, covered for 4 hours and dried.

Nos. 5 and 16 ... Seed sprinkled with 1/320 Formaldehyde solution, covered for 4 hours and dried.

Nos. 6 and 17 ... Seed sprayed with equal parts of 40 per cent. Commercial Formalin and water, covered for 4 hours and dried.

Nos. 7 and 18 ... Seed steeped in Germisan 0·25 per cent. solution for 30 minutes, drained, and dried at once.

Nos. 9 and 19 ... Seed dusted with Copper Carbonate Powder.

Nos. 10 and 20 ... Seed dusted with Copper Carbonate $Hg.Cl._2$ Powder.

Nos. 11 and 21 ... Seed dusted with Abavit Powder (200 grms., per cwt.).

The number of smutted plants in each plot was counted before the crop was harvested and subsequently representative samples of the grain were examined in the laboratory for smut spores. It was found, as in the previous trials, that the laboratory methods of determining the degree of smut infection agreed very closely with the method of counting adopted in the field.

In Table VI. are set out the results of the experiments showing the relative effect of the various treatments on the prevalence of the stripe disease, also the number of smutted plants counted in each plot, together with the yields of grain produced.

TABLE VI.

TREATMENT FOR PREVENTION OF SMUT AND STRIPE DISEASE 1927.

Plot Nos.	Treatment.	Stripe Disease.	No. of smutted plants counted. Series. 1	2	Yield. Series. 1 sts.	lbs.	2 sts.	lbs.	Average sts.	lbs.
1 & 15	Untreated	Very Prevalent	483	238	11	11	10	12	11	5
8 & 22	.. ..	.. ...	325	485	11	13	11	9	11	11
2 & 12	Formalin 1/240 ...	Not Prevalent	12	7	12	4	12	0	12	2
3 & 13	Formalin 1/320 ...	Fairly Prevalent	95	33	12	7	11	4	11	12
4 & 14	Formalin 1/480 ...	Prevalent ...	183	59	12	6	11	3	11	11
5 & 16	Formalin Sprinkled 1/320.	Very Prevalent	286	154	12	0	11	0	11	7
6 & 17	Formalin spray equal parts.	Very Prevalent	10	7	11	12	10	10	11	4
7 & 18	Germisan	Prevalent ...	32	10	12	3	11	6	11	11
9 & 19	Copper Carbonate ...	Prevalent ...	27	152	13	3	11	4	12	3
10 & 20	Copper Carbonate and Mercuric Chloride.	Prevalent ...	6	3	13	0	11	9	12	4
11 & 21	Abavit Powder ...	Not Prevalent	1	0	12	4	12	5	12	4

Note.—The first column of each pair refers in each case to the lower numbered plot.

It will be observed that the Abavit powder treatment proved very effective in the prevention of smut, and it is also evident that the dressing exercises some control over stripe disease. As in the previous season's trials the Copper Carbonate and Mercuric Chloride dressing again proved very effective in controlling smut. As this mixture has, however, an irritating effect on the respiratory organs, care should be exercised in applying it, and it should only be mixed with the seed in an enclosed vessel. Treatment with Formalin 1/240 was only slightly less effective in controlling smut than the Abavit or Copper Carbonate-Mercuric Chloride dressings, and it proved to be equal to Abavit in preventing the spread of stripe disease. Further and contrary to the results obtained in similar trials conducted in the previous year this Formalin treatment does not appear to have injuriously affected the germinating capacity of the grain. Formalin and water (equal parts) applied as a spray whilst effective in controlling smut appears to have had an injurious effect on the grain, as the yield was considerably reduced. The weaker solutions of Formalin in water reduced the yield and did not prevent attacks of smut or stripe disease. Copper Carbonate alone was not so effective in controlling smut as the mixture of Copper Carbonate and Mercuric Chloride. The Germisan treatment which had given promising results in the previous trials did not prove so satisfactory in the past season's trials.

WHEAT.

I.—PROPAGATIONS.

(i.) *Pedigree Selections.*

Propagation of pedigree selections of Yeoman, Yeoman 2, Red Stettin 13, Coney Island, Old Irish Red (ex Donegal), Old Irish Red (ex Galway), Iron-Master, Yeoman-Red Stettin 6/1 and 6/2, Yeoman-Iron 5/2, Red Fife and April Red were continued during the past season in nursery, garden and field plots at the Albert Agricultural College, Glasnevin, Co. Dublin.

A number of very promising selections were made from a plot of White Velvet wheat grown on the College farm during the past season. This is an old native Irish wheat noted in former times for the quality of its grain produce. It is still grown to a small extent in Co. Louth, and the seed for the sowing of the plot referred to was obtained from that county. Like the majority of unselected native varieties it is now very mixed and comprises a number of types or sub-varieties differing botanically and physiologically from each other, and the object in making the selections was to discover in due course whether any of the numerous sub-varieties possessed characters of economic importance.

New forms derived from crosses between Queen Wilhelmina and Yeoman, Yeoman 2 and Red Stettin 13, etc., were grown under observation in the cereal nursery during the past season, and selections were made therefrom for further propagation.

(ii.) *Extension Plots.*

An extension plot of Coney Island (long straw) was arranged for at each of the Department's Agricultural Stations, Athenry, Co. Galway, and Clonakilty, Co. Cork. The area of each plot was approximately one statute acre. A plot of Coney Island (short straw) comprising one and a-half statute acres was also grown on the Albert College Farm, Glasnevin.

A large propagation plot of Red Stettin wheat comprising about three Irish acres was grown on the farm of Mr. P. O'Connor, Knocklofty, Clonmel, Co. Tipperary. From this area 46 barrels, 4 stones or 115 hundred weights and 4 stones of dressed grain were obtained. The grain was of exceptionally fine quality, equivalent, in the opinion of several millers, to Manitoba Wheat No. 2.

A small scale baking test on samples of flour from this wheat showed that it was sufficiently strong for the making of loaves of high volume, and, moreover, in other respects, notably as regards flavour, it compared favourably with loaves made from an ordinary commercial mixture.

The Department have arranged to have large scale plots of Red Stettin 13 grown at several centres in Co. Tipperary from the produce of Mr. O'Connor's plot, and, moreover, they have arranged to have it tested in quantitative experimental plots at various centres throughout the country to determine its suitability for general cultivation.

Red Stettin 13 appears to be a typically strong wheat and is suited for loaf bread manufacture. It would appear, however, not to be well suited for soda bread making for which a weaker wheat, *i.e.*, one with a low percentage of gluten, would be more satisfactory.

An observation plot of Cambridge Browick was grown at the Albert College, Glasnevin. This variety possesses great strength of straw and is, therefore, suited for very heavy soils. The grain is, however, very soft in texture and apparently of indifferent milling quality when grown under Irish climatic conditions. It is, moreover, very susceptible to attacks of Yellow Rust (P. Glumarum) and on this account its cultivation ought to be confined to those areas where this disease is not prevalent. For ordinary heavy soils it has been found that Yeoman or Yeoman 2 wheats possess straw sufficiently strong to resist lodging and are recommended for cultivation in Saorstat Eireann, in preference to Cambridge Browick.

II.—Wheat Variety Experiment.

A small scale chessboard wheat variety experiment was carried out at the Albert Agricultural College during the past season. The varieties comprised two hybrids derived from a Yeoman and Iron Cross, three from a Yeoman and Red Stettin 13 cross, with Yeoman 2 as standard.

The result of this experiment is set out in the following Table in which the varieties are given in the order of yield of grain. The figures given are the average mean of five separate tests.

Variety.	Yield in Grains.	Taking Yeoman 2 as 100.
Yeoman-Iron 1/1	251·4	115
Yeoman-Iron 5/2	248·8	114
Yeoman Stettin 5/1	244·8	112
Yeoman Stettin 6/2	224·2	103
Yeoman 2	218·6	100
Yeoman 2 3/1	187·8	86

In view of the large variations in yield of grain which took place between the individual plots of each of the varieties tested, the results given above have no statistical significance. Further propagations of the hybrid forms which have outyielded Yeoman 2 are being made, and it is proposed to test these against Yeoman 2 and other commercial varieties in large scale tests in due course.

OATS.

I.—Propagations.

(i.) *Pure Line Cultures and Hybrids.*

(*a*) Propagations of pure line selections of Victory, Victory (new selection), Victory 2, Banner, Abundance, Potato (3 selections), Sandy, Banner-Tartary 9, Record, Victory-Mogul 12/2/1, Banner-Victory 2, Wexford Tawny, Black Tartary, Black Tartary (new selection No. 1) and Black Mogul were continued during the season of 1927 in nursery, garden, and field plots at the Albert Agricultural College, Glasnevin, Co. Dublin.

Promising new forms derived from crosses between Record and Victory, Black Tartary and Victory 2, Banner-Tartary 9 and Victory 2, Banner-Tartary 9 and Marvellous were also propagated on the Albert Agricultural College Farm in 1927. In addition crossings between Mansholt's III. and Victory-Mogul 12/2/1, Black Mogul and Victory-Supreme 5, Victory-Mogul 4/3/2 and Victory-Supreme 5, were successfully carried out.

(*b*) Small Extension plots of Black Englebrect, Black Tartary, Black Tartary (new selection No. 1), Abundance and Mansholt's III. were grown at the Department's Cereal Station, Ballinacurra, Co. Cork. Large Extension plots of Banner-Tartary 9 (six acres) and Record (two acres), were grown at the Albert Agricultural College, Glasnevin.

Department's Oat Propagation Scheme.

In collaboration with the Agricultural Instructors, the Department have had under operation for several years an Oat Propagation Scheme, under which comparatively large stocks of pedigree strains of the most prolific and valuable varieties of oats are distributed annually to selected farmers for the growing of *County Extension Plots*. Growers of these plots are required to undertake that the grain produce will, if suitable, be reserved for seed, and that the quantity not required for the grower's own seed requirements will be sold for seed purposes to farmers in the vicinity in which the respective plots are situated, at a reasonable price.

As the land at the disposal of the Department at the Ballinacurra Cereal Station is limited, it has become necessary, in order that sufficient stocks of pedigree seed to meet the continually increasing demand for County Extension Plots may be provided, to grow large plots of pedigree oats on the lands of reliable farmers within easy reach of Ballinacurra. These plots are grown under the direct supervision of officers of the Seed Propagation Division who supervise sowing, cleaning and harvesting operations. After threshing, the produce of each plot is delivered immediately to the Ballinacurra Cereal Station where it is dried, re-cleaned and stored under the most favourable conditions. Oat plots grown at Ballinacurra under the conditions set out are known as *Department's Extension Plots.*

(ii.) *Department's Extension Plots.*

In 1927 *Department's Extension Plots* of Oats were grown as follows :—

Victory, 7 acres on the farm of Thomas Twomey, Ballintubber, Carrigtwohill, Co. Cork.

Victory II., 9 acres on the farm of Denis Mulcahy, Ballintubber, Carrigtwohill, Co. Cork.

Crown, 7 acres on the farm of James Simpson, Ballymaloe, Cloyne, Co. Cork.

B. Tartary (new selection No. 1), 10 acres on the farm of James Deasy, Barryacourt, Carrigtwohill, Co. Cork.

B. Tartary, 7½ acres on the farm of C. Deasy, Loughathalia, Ballinacurra, Co. Cork.

The produce of each of the above plots was saved in good condition and was reserved for County Extension Plots in 1928.

(iii.) *County Extension Plots.*

In the following list the growers of County Extension Plots in the season 1927, the variety grown in each case, and the quantity of pedigree seed supplied are set out :—

Variety.	*Name and Address of Grower.*	*Quantity of Seed supplied.*
		Stones.
VICTORY II. ...	J. Leahy, Abbeylands, Castlelyons, Co. Cork ...	84
,, ...	J. McHugh, Caherlistrane, Headford, Co. Galway	14
,, ...	J. Spain, Rapla, Nenagh, Co. Tipperary ...	98
,, ...	R. Gregan, Bennettstown, Dunboyne, Co. Meath...	70
,, ...	Wm. O'Connor, Clough, Ballacolla, Leix ...	56
,, ...	L. Sheil, Cuffsboro', Leix	28
,, ...	D. Humphreys, Boher, Co. Limerick	21
,, ...	T. Looney, Pust, Caherconlish, Co. Limerick ...	21
,, ...	James Fitzgerald, Tobernea, Co. Limerick ...	42
,, ...	F. Harty, Ardfert, Co. Kerry	[illegible]
,, ...	J. Connolly, Rahins, Castlebar	14
,, ...	J. McLoughlin, Derrycush, Castlebar	14
,, ...	T. Lawlor, Tomardhower, Milford	28
,, ...	Mrs. B. M. Byrne, Paulville, Tullow	56
,, ...	J. Donovan, Coolmakee, Macroom	16
,, ...	Agricultural School, Clonakilty	18
,, ...	W. H. Frost, Glenbrook, Bandon	20
,, ...	C. Duggan, Greenfield, Ballincollig, Co. Cork ...	16
,, ...	P. O'Connell, Killumney House, Ovens, Co. Cork	16
,, ...	D. McCarthy, Ballyhahill, Co. Limerick ...	14
,, ...	R. Stack, Broadford, Charleville, Co. Limerick ...	28
,, ...	E. Wall, Lower Belmount, Crookstown, Co. Cork	16
,, ...	P. Sheridan, Kilrush, Dungarvan, Co. Waterford	84
,, ...	P. J. Carey, Skagh, Skibbereen, Co. Cork ...	16
,, ...	J. Crossan, Shercock, Co. Cavan	56
,, ...	T. Hickey, Ballydehob, Co. Cork	16
,, ...	Mrs. C. McCarthy, Skibbereen, Co. Cork ...	16

(iii.) **County Extension Plots**—*continued*.

Variety.	*Name and Address of Grower.*	*Quantity of Seed supplied.*
		Stones.
VICTORY II. ...	T. O'Donoghue, Cross-east, Cong, Co. Mayo ...	14
,, ...	T. Mullanny, Davidstown, Co. Waterford ...	42
,, ...	T. Ring, Clashduff, Co. Kilkenny	42
,, ...	J. Grey, Timlin, Ballytore, Co. Kildare ...	98
,, ...	D. O'Donovan, Aughadown, Skibbereen, Co. Cork	16
,, ...	Joseph McGrath, Kilcullen, Co. Kildare ...	70
,, ...	Denis McGrath, Abbey Farm, Clonmel, Co. Tipperary	42
,, ...	C. Purcell, Orchardstown, Clonmel, Co. Tipperary ...	49
,, ...	N. Hughes, Balief, Co. Kilkenny	42
,, ...	M. Kearney, Cullen, Leap, Skibbereen, Co. Cork ...	16
,, ...	J. O'Flynn, Annaghdown, Co. Galway	16
,, ...	D. Hayes, Cusheen, Schull, Co. Cork	32
,, ...	S. J. Malone, Clonmoyle, Kildare	126
,, ...	M. Hogan, Cappagh, Co. Waterford	28
,, ...	M. Forde, Ballingarry, Loughrea, Co. Galway ...	28
,, ...	J. Keane, Coorheen, Loughrea, Co. Galway ...	28
,, ...	J. Burke, Rathmoon, Co. Wicklow	28
,, ...	J. J. Bourne, Forttown, Tinahely, Co. Wicklow ...	14
,, ...	J. Kavanagh, Tinahely, Co. Wicklow	14
,, ...	J. Wolahan, Dunbur, Co. Wicklow	14
,, ...	Bryan McSweeney, Jamesbrook, Ballinacurra, Co. Cork	28
,, ...	T. Hynes, Craughwell, Co. Galway	14
,, ...	M. Nugent, Springfield, Clonmel, Co. Tipperary ...	21
,, ...	M. Canty, Carrigaline, Co. Cork	28
,, ...	John Powell, Glounties, Dunmanway, Co. Cork ...	28
,, ...	T. Hennessy, Mountcotton, Ballymacoda, Co. Cork ...	46
,, ...	D. Daly, Castledaly, Co. Galway	28
,, ...	G. R. Whelan, Raheen, Co. Wicklow	28
VICTORY ...	James Pigott, Rathcomane, Ballyhar, Co. Kerry ...	56
,, ...	Wm. Smyth, Dromoland, Newmarket-on-Fergus, Co. Clare	70
,, ...	Rev. M. Kelly, St. Peter's College, Wexford ...	70
,, ...	P. J. Gorry, Kilcavan, Geashill, Offaly	28
,, ...	R. Ahern, Ballymakeigh House, Killeagh, Co. Cork ...	14
,, ...	Stephen Collins, Glenane House, Killeagh, Co. Cork	14
,, ...	Wm. Carey, Ballinagun, Cree, Co. Clare ...	28
,, ...	P. Frawley, Clonanmore, Cree, Co. Clare ...	28
,, ...	N. Healy, Ballinagun, Cree, Co. Clare	28
,, ...	T. Gowing, Kilminchy, Heath, Leix	42
,, ...	John Foy, Brackagh, Welsh Island, Offaly ...	70
,, ...	Bat. Murray, Dunmoon, Tallow, Co. Waterford ...	70
,, ...	E. O'Gorman, Wallen Grange, Co. Kilkenny ...	63
,, ...	James St. John, Cramps Castle, Fethard, Co. Tipperary	56
SVALÖF CROWN ...	Agricultural School, Ballyhaise, Co. Cavan ...	98
,, ...	Ml. O'Donnell, Church Place, Arraglen, Co. Cork ...	70
,, ...	Ml. Quinlivan, Gower Hall, Cooloclare, Co. Clare...	56
,, ...	Bat. Crowley, Brealire, Co. Clare	28
,, ...	Martin Keating, Ballykeet, Kilrush, Co. Clare ...	28

(iii.) **County Extension Plots**—*continued.*

Variety.	*Name and Address of Grower.*	*Quantity of Seed supplied.*
		Stones.
SVALÖF CROWN ...	D. Grehan, Ballinagore, Co. Westmeath ...	70
,, ...	J. Duan, Johnstown, Co. Kilkenny	98
,, ...	P. Lowther, Rathglass, Ballina, Co. Mayo ...	24
,, ...	R. O'Connell, Rathirn, Fethard, Co. Tipperary ...	98
,, ...	J. Mason, Gormanstown, Ardfinnan, Co. Tipperary ...	38
,, ...	T. McGlynn, Loughrea, Co. Galway	28
BLACK TARTARY ...	A. Hickey, Templemore, Fermoy, Co. Cork ...	70
,, ...	M. Kelly, Castle Ellis, Enniscorthy, Co. Wexford ...	42
,, ...	Myles O'Connor, Ballymacsimon, Co. Wexford ...	84
,, ...	Hugh Kelly, Ballintemple, Offaly	28
,, ...	E. Byrne, Rathoe, Tullow, Co. Carlow	42
,, ...	E. Doyle, Craans, Tullow, Co. Carlow	42
,, ...	Miss H. O'Keeffe, Garryhesta, Ovens, Co. Cork ...	72
,, ...	T. Gould, Castlemore, Crookstown, Co. Cork ...	30
,, ...	J. Lehane, Crossmahon, Lissarda, Macroom, Co. Cork	24
,, ...	J. Downey, Carran, Dunbell, Co. Kilkenny ...	28
,, ...	E. Morrisson, Tallow, Co. Waterford	63
,, ...	P. McCarthy, Monaghan South, Skibbereen, Co. Cork	16
,, ...	Wm. Burke, Kilamore, Clonmel, Co. Tipperary ...	140
,, ...	J. Donovan, Skeagh, Skibbereen, Co. Cork ...	48
,, ...	P. O'Donoghue, Cornishal, Leap, Skibbereen, Co. Cork	32
,, ...	Mrs. A. M. Byrne, Redcross, Co. Wicklow ...	42
,, ...	R. Crosbie, Hodgestown, Co. Kildare	35
,, ...	J. Baldwin, Tallow, Co. Waterford	28
,, ...	T. Meehan, Ballyduff, Co. Wicklow	28
,, ...	E. Campbell Boyd, Ballinglen, Co. Wicklow ...	28
,, ...	E. Byrne, Keatingstown, Wicklow	28
,, ...	E. Boyle, Marl Hill, Ardfinnan, Co. Tipperary ...	70
,, ...	E. P. Foley, Crossabeg, Wexford	70
,, ...	James Tobin, Cregg, Skibbereen, Co. Cork ...	32
,, ...	J. Kingston, Templebrian, Clonakilty, Co. Cork ...	40
,, ...	P. Barry, Dungourney, Co. Cork	32
,, ...	John Ryng, Kelleendooling, Midleton, Co. Cork ...	42
,, ...	Michael Murnane, Milltown, Midleton, Co. Cork ...	28
,, ...	Ml. O'Brien, Ballymartin, Dungourney, Co. Cork ...	48
BANNER ...	Agricultural School, Darrara, Clonakilty, Co. Cork ...	140
POTATO ...	Agricultural School, Athenry, Co. Galway ...	105
,, ...	E. O'Kane, Cowen, Killygordon, Donegal ...	42
POTATO II. ...	Wm. Doherty, Cashel, Donegal	56
,, ...	W. J. McElhinney, Letterkenny, Donegal ...	28

II.—Quantitative Variety Experiments.

Large Scale Variety Experiments.

(i.) *Winter Sown Oats.*

A winter sown oat variety experiment was carried out in 1927 on the Albert Agricultural College farm, on land which, in the previous year, was cropped with potatoes. The potatoes received a dressing of farmyard manure at the rate of 10 tons per statute acre supplemented by the standard mixture of artificials, which was applied at the rate of 6 cwts. per statute acre. When the potatoes were lifted, the land was immediately ploughed, but for various reasons it was not found possible to sow the oat variety plots until the second week in December, 1926. This would normally be regarded as being too late for the sowing of winter oats, but at the time referred to very fine, bright and comparatively warm weather was experienced and the ground was in splendid tilth.

The following varieties were included in the test :—Marvellous, Mansholt's III., Victory-Mogul 12/2/1, Banner-Tartary 9, and Victory II.

With the exception of Marvellous—which was secured from a local seed merchant—the seed of the varieties were obtained from the produce of pedigree plots grown during the previous year on the College farm. Two plots of each variety were grown, *i.e.*, there were two series of plots ; and the arrangement of the varieties in each series was randomised. In this way it was hoped to minimise the effects of soil variations on the results, and the random arrangement ensured that fairer results would be obtained than if the plots were arranged on some preconceived scheme.

All the plots were overground on the 19th January, 1927. Mansholt's III. came up much more rapidly than the other varieties, and was five days in advance of Banner-Tartary 9, the latest variety to appear overground. Subsequently the plots did very well, and at the beginning of March all of them looked particularly promising.

With the exception of a short period which occurred in the month of May the summer was very wet and there was a considerable deficiency of sunshine as a result. This had a somewhat adverse effect upon the early development of all the plots which did not grow as rapidly as might be expected during the late spring and early summer months. This was especially noticeable in the case of Banner-Tartary 9 which, until the end of June, was distinctly more backward than any of the other varieties. Subsequently, however, this variety grew very rapidly, and at harvest time had produced a very heavy crop, comparing favourably with that of any of the other varieties.

Unfavourable harvesting conditions were experienced during the entire month of August, and although all the winter oat plots were ripe by the middle of that month it was not until the 30th of August that the reaping of the plots could be carried out. An excellent opportunity was therefore afforded to ascertaining the manner in which each particular variety responded to the delaying of harvesting for a considerable period beyond the normal time.

Banner-Tartary 9 and Mansholt's III. were not affected in any way. There was no loss of grain and the straw of each retained its strength and stood perfectly erect until cut. The stems of a small proportion of the plants of Victory II. and Marvellous became bent at the lowest node—" knee bending "—but this bending of the stems did not take place to such an extent as to occasion loss of grain through the cutting off of the heads by the reaper. The stems of a large proportion of Victory-Mogul 12/2/1 bent rather badly; many of the heads lying close to the ground were lost in harvesting. It would appear that ability to resist conditions of over-ripeness is a very desirable characteristic, especially in districts where unfavourable harvesting conditions may be expected.

Marvellous suffered more severe damage through attacks of small birds—principally sparrows and finches—than any of the other varieties. Damage from the same cause has been observed in the case of Marvellous in previous years, and it is believed that the low position occupied by this variety, comparative to the other varieties in respect of yield of grain per statute acre in the trials conducted on the Albert College farm, is due principally to the depredations of birds. It is quite evident that the close " sidey " type of ear which is characteristic of Marvellous provides not only an excellent perch for small birds but enables them to reach a large proportion of the spikelets without difficulty. For this reason Marvellous is not relatively as suitable a variety for cultivation in the vicinity of towns where sparrows are numerous as it undoubtedly is in those areas where bird damage is negligible.

In the following Table the yields of grain per statute acre in barrels and stones and in hundred weights and stones, and of total produce (grain and straw), in tons and hundred weights are set out. The varieties are given in the order of yield of grain. The figures given in each case are the average of the weights recorded for the two separate plots of each variety:—

Variety.	Yield of Dressed Grain.				Yield of Total Produce.	
	brls.	sts.	cwts.	sts.	tons	cwts.
Banner-Tartary 9	18	12	33	0	4	18
Mansholt's III.	18	11	32	7	—	—*
Victory II.	18	9	32	5	4	8
Victory-Mogul 12/2/1	17	3	30	1	4	4
Marvellous	16	0	28	0	4	8

* Owing to an oversight the total produce of this variety was not recorded.

It will be noted that as regards yield of dressed grain per statute acre the differences separating Banner-Tartary 9, Mansholt's III. and Victory 2 are very small and are well within the limits of experimental error. Banner-Tartary 9 produces, however, a comparatively small grain, and it was ascertained that it produced about eight stones more seconds than any of the other varieties. This was not allowed for in the above Table.

Although each of the varieties included in the above experiment yielded well and did not suffer in any degree from winter-killing, it should be remembered that the plots were grown on a well drained soil. It is the experience of the Department that winter oats will only be successful on a dry soil with a good aspect. Experience at the Albert Agricultural College has shown that the danger to be apprehended in the case of winter oats is not damage from frost but rather from water-logging of the soil. Farmers who desire to sow winter oats are advised to exercise due caution and to experiment with a number of leading varieties including genuinely resistant sorts such as Bountiful and Black Winter before entering on cultivation on a large scale.

(ii.) *Spring Sown Oat Variety Experiment.*

This experiment was conducted on the Albert College Farm, on land which, in the previous year, was cropped with mangels. The varieties included in the test were :—Banner-Tartary 9, Victory-Mogul 12/2/1, Victory 2, and Mansholt's III. The seed for the sowing of each variety was obtained from the Department's pedigree stocks of these varieties grown during the previous year on the College farm. Two plots of each variety were sown so as to minimise yield differences due to soil variation and, as in the previous experiment, the arrangement of the plots was fort itous.

All the plots were sown on the 18th February, 1927, on a good and well prepared seed bed. Immediately after sowing the weather broke, and it was not possible to roll or harrow the plots. Notwithstanding, the brairds were satisfactory in every case. Mansholt's III. was overground before the other varieties, and in this respect was about four days in advance of Banner-Tartary 9, which, as usual, germinated slowly.

During the spring months all the plots tillered well and grew rapidly. There was practically no trace of any fungoid disease, and owing to the earliness of the sowing, the frit fly (O. frit) did no damage whatever. The wet weather experienced during June and July had no adverse effects on the growth of any of the varieties, and very heavy stands were obtained in every case. It was remarkable that none of the plots became lodged, but it is probable that this may have been due to the fact that, owing to the month of May being very dry, it was necessary for the oat plants to develop their rooting system and to push the roots deep down into the soil during that period so as to obtain the necessary moisture for growth.

Harvesting operations could not be carried out until the beginning of September, and, in consequence, all the plots were somewhat over-ripe. As a result Victory-Mogul 12/2/1 became, just before harvesting, slightly bent at the first node.

In the following Table, the weight of dressed grain in barrels and stones and in hundred weights and stones, and the weight of the total produce in tons and hundred weights per statute acre are set out. The figures given

are in each case the average of two separate determinations, and the varieties are arranged in the order of yield of grain.

Variety.	Weight of Dressed Grain.				Weight of Total Produce.	
	brls.	sts.	cwts.	sts.	tons	cwts.
Banner-Tartary 9*	23	1	40	3	5	16
Victory-Mogul 12/2/1	20	4	35	4	4	10
Mansholt's III.	19	12	34	6	4	10
Victory 2	18	4	32	0	4	12

* Banner-Tartary 9 also gave a higher proportion of seconds than any of the other varieties.

It will be noted that Banner-Tartary 9 gave the highest weight of total produce and of dressed grain per statute acre. Since 1923, when it was first included in the large scale variety tests conducted at this College, it has, in every experiment, proved superior to any other variety with which it was tested in yield of grain and straw, and as, moreover, it stands well, it is evidently particularly suited for cultivation on rich heavy soils. Banner-Tartary 9 has also given the highest weight of grain and straw in the trials conducted throughout the Saorstat by the Agricultural Instructors during the years 1926 and 1927, and it would appear from the results obtained that this variety is, in addition, suited for cultivation on a fairly wide range of soils. Nevertheless, pending further tests, the Department advises that its cultivation should be restricted to soils above the average in fertility.

(iii.) *Small Scale Oat Variety Tests* (*Chessboard*).

It has hitherto been usual to conduct small scale chess-board experiments in the cereal nursery, but during the past season a small scale experiment was conducted in the open field with very satisfactory results. Little or no damage was caused by birds, field vermin or insect pests, and no fungoid disease was observed in any of the plots. Six varieties were under test, viz. :—Victory 2, Victory (new selection), Victory-Mogul 12/2/1, Banner-Victory 2 No. 1, Banner-Victory 2 No. 2, and Abundance-Tawny. With the exception of Abundance-Tawny, (the seed of which was only sufficient for the sowing of 13 plots), there were 18 of each variety, the plots being so arranged as to secure that on the average each variety would have approximately equal environmental conditions, especially as regards soil. The plots were each one square yard in area. The varieties are arranged in order of dressed grain

per statute acre. In the following Table the weight of dressed grain and straw per plot are set out :—

Variety.	Average Weight of Dressed Grain.	Average Weight of Straw.
Victory (new selection)	316 grams.	349 grams.
Banner-Victory 2, No. 1	312 ,,	341 ,,
Victory 2	303 ,,	341 ,,
Victory-Mogul 12/2/1	302 ,,	369 ,,
Banner-Victory 2, No. 2	301 ,,	324 ,,
Abundance-Tawny *	270 ,,	393 ,,

* Average of 13 plots only.

It was ascertained on the determination of the standard deviation of the mean difference between contiguous plots of the various varieties when taken together in pairs that the difference in respect of yield of dressed grain separating Victory, Banner-Victory 2, No. 1, Victory 2, Victory-Mogul 12/2/1 and Banner-Victory 2, No. 2, were not significant of any varietal superiority, and might well have been caused by environmental differences which could not have been provided against. Abundance-Tawny is, however, significantly inferior to Victory (new selection) and Banner-Victory 2, No. 1 in yield of grain, and the probability is very great that this inferiority is due to a varietal cause. Owing to the wide variations which occurred in the yields of straw from plots of the same variety, no significance can be attached to the differences in the figures as respects straw, which are set out above.

FLAX.

A quantitative variety experiment with flax was carried out during the season 1927 at eight centres. In the following Table the average yield of scutched flax per statute acre, the percentage of scutched flax from retted straw, the value of the scutched flax per stone, and the return from scutched flax are shown.

AVERAGE RETURNS PER STATUTE ACRE FROM EIGHT CENTRES.

Variety of Flax.	Yield of Scutched Flax.		Percentage of Scutched Flax from Retted Straw.	Value of Scutched Flax per stone. *		Return from Scutched Flax.		
	sts.	lbs.		s.	d.	£	s.	d.
1 Danish Pedigree No. 21	43	3	17·1	13	6	29	3	5
2 Department's Pure Line No. 6	31	2	14·3	13	2½	20	11	4
3 Riga	30	13	14·1	13	3	20	9	10
4 Riga (Unmanured) ...	26	9	12·9	13	4	17	15	3
5 Dutch	25	6	13·3	12	11	16	8	5
6 Pernau Crown ...	25	2	13·5	12	10	16	2	8

* The flax grown on each plot at each centre was valued separately; these figures epresent the average of the valuations.

Each variety, with the exception of No. 4 (which was unmanured), received a manurial dressing of $1\frac{1}{2}$ cwts. of Muriate of Potash and $\frac{1}{2}$ cwt. Sulphate of Ammonia per statute acre.

It will be observed that of the varieties tested Danish Pedigree 21 was superior in regard to both yield of scutched flax and in monetary return. The Department's Pure Line No. 6 was next highest both in respect of yield of scutched flax and monetary return. and, as in the previous season's trials, Riga flax again proved superior to Dutch flax and Pernau Crown. The average returns from the manured as compared with the unmanured plots show distinctly the advantages of applying a suitable dressing of artificial manures to the flax crop.

ESTIMATION OF YEASTS AND MOULDS IN BUTTER.

Influence of the Hydrogen-ion Concentration of the Medium on the Mould and Yeast Counts of Butter.

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Recent developments in the field of butter control work point to the necessity for the adoption of some standards for use in the bacteriological laboratory. Up to the present very little success has been attained in the efforts to correlate the bacterial content with the conception of "quality" or the keeping properties of butter. This cannot be said of the yeast and mould content. It is true, no doubt, that there is no constant relation between "quality" and the count. It has been found in this laboratory, in common with work carried out by others elsewhere, that butters which score high in flavour and quality generally may, nevertheless, have relatively high yeast and mould counts. No doubt, however, exists that there is a striking parallelism of the mould and yeast content of the finished product, with the care and efficiency in pasteurisation, cleanliness of the creamery, equipment, and general management of the manufacturing plant. It has been clearly demonstrated by many investigators that the creamery and its equipment is the main source of mould and yeast infections. The tables presented by Hood and White (1)* are especially interesting in this connection. It is evident from these tables that pasteurisation is practically misdirected energy if recontamination be not avoided. If the yeast and mould counts are then to be taken as an index of the care that should be exercised in the manufacture of butter, it is important that a standard method be observed for making such an estimation.

This investigation is the result of routine work carried out at the Butter Testing Station with the ultimate object of the biological control of butter produced in this country, and of the placing of the award of the National Mark on a scientific basis. Hood and White (*loc. cit.*) have shown that pasteurisation of cream at 180° F. for 10 minutes kills off all yeasts and moulds. O. F. Hunziker (2), in summarising the efficiency of pasteurisation in destroying yeasts and moulds, states that a temperature of 185° F. for 30 seconds is 99·9 per cent. efficient. The work of Stiritz (3) also shows that the flash method of pasteurisation (where a temperature exposure of 185° F. for 30 seconds is used) kills off 99·9 per cent. of the yeasts and moulds. The flash method, 190-195° F., is that generally used in this country. If, then, a finished butter is found to contain a high count of either group, suspicions arise as to the efficiency of the pasteuriser or the general hygienic conditions of the cooling and storage vats, the conducting system, the churn, the water supply, the salt, or the parchment liners. In order to secure an insight into the conditions under which the butter was manufactured the plate count of yeasts and moulds was taken as an index.

It soon became evident that investigations hitherto made on this branch

* Reference is made by number to "Literature cited" at end of this paper.

of the work had been carried out on media of a variable composition, and the variations of media became still more evident when their relative acidities were considered. The media used differed widely in the basic nutriment offered to the developing organisms, but undoubtedly a more important factor was introduced in the hydrogen-ion concentration.

Reference to the literature on the subject substantiates the foregoing remarks. Hood and White (1) used an unhopped beer wort agar medium, adjusted to pH 3·5 before plating by the addition of lactic acid, but as a result of their research (4) they subsequently recommended the use of a Bacto-malt-agar dehydrated preparation of the Digestive Ferments Company, Detroit, and indicated that it should be acidified according to the maker's directions to a final pH value of 3·5 before plating. Lund (5) employed a similar base as that originally used by Hood and White: it was acidified with lactic acid so as to inhibit all growth of bacteria. Whey was the base in the media employed by Hunziker (6), Bouska (7), Macy (8) and Grimes (9). They assigned no definite pH value to their media, but specified acidification with either lactic or tartaric acids. Stiritz (3) used a whey agar medium in the earlier part of his work. Later, however, he employed nutriment from malt drinks ("near beer") as a medium. This was acidified before plating by the addition of 4 c.c. of sterile 5 per cent. lactic acid, the author remarking that "this acidity was sufficient to inhibit the growth of organisms other than yeasts and moulds." Abbott (10) used the "near beer" wort also.

It has been found that yeasts and moulds tend to tolerate generally a medium of high acidity for development and that bacteria require a less acid substratum; advantage is taken of this fact in the separation of yeasts and moulds from bacterial contamination. As the acidity is increased to below pH 4 there is an almost complete inhibition of visible growth of bacteria on a plate culture over a short period of time. As that hydrogen ion concentration is reached, the optimum of many yeast types is approached. The work of Hagues (11), who found that yeast reproduces most vigorously at two widely separated points on the pH scale, viz., 4 and 8·5, is of particular interest in this connection. The same author (10), working on the reproduction of *Saccharomyces cerevisiae* and *S. ellipsoideus*, showed both to exhibit two maxima, one at pH 4 and the other at pH 8·5. Continuing this work (12) on the reproduction constants of wild yeasts, to which beer and wort are susceptible as contamination, he found that *S. ellipsoideus* I has two maxima corresponding to *S. cerevisiae*, and that *S. pastorianus* I and *S. pastorianus* III, as well as having two maxima at pH 4 and pH 8·5, have also a third maximum at pH 6·5. He concluded that the mechanism of all reproduction depends upon the activities of a group, or groups, of proteolytic enzymes whose optimum activities occur at the points in the pH scale mentioned.

The work of Hagues has a particular bearing on the subject under review; that is, the effect of the pH value of the medium on the growth of the yeast and mould flora of butter. A medium which inhibits the growth of bacteria should at the same time offer a suitable range of acidity for the development of the maximum number of yeast colonies. The ideal solution

of the problem would be the discovery of a substratum or of a synthetic medium which would permit the growth of all yeast types found in butter and make their plate count straightforward. If future investigation should demonstrate that most species of yeasts found in butter made under unhygienic conditions flourish, or have one of their optima in the region of pH 4, then the adoption of a standard medium of about pH 3·5 would be the natural consequence. The recent work of Hood and White (4) goes very far towards the solution of the problem.

The standard medium used for the enumeration of yeasts and moulds in the Station laboratory at the commencement of the work was a wort agar with a pH value of 6·5. Repeated observations, however, in hanging drop of small colonies developing in this medium, proved that at least 50 per cent. of the colonies were bacteria. It was decided then that as many samples as possible, time permitting, would be plated in parallel on this medium with a decreasing pH value..

Through the courtesy of Messrs. Guinness, St. James's Gate Brewery, Dublin, fresh unhopped wort was always obtainable. It was diluted with an equal volume of distilled water and the composite liquid was adjusted to the desired hydrogen ion concentration. The electrometric titration curve was determined on a portion of the wort and the pH value was then adjusted by the addition of the required quantities of standard hydrochloric acid or caustic soda. Check determinations were always carried out and, when necessary, readjustments were made. The hydrogen exponent was determined with the quinhydrone electrode of Biilmann (13) using the temperature co-efficient of the same author (14). In the earlier part of the work the standard quinhydrone electrode of Veibel (15) was used, but later the saturated calomel electrode was adopted for convenience as a standard and was assigned the E (cal.) values given by Clarke (16). The small change of pH value due to sterilization was determined and allowed for in the adjustment. Bacto Agar, 2 per cent., was added to the wort, as diluted, and the medium was tubed in 10 c.c. quantities and sterilized at 15 lbs. pressure for 20 minutes.

As already indicated, the *data* presented in this paper are a result of an attempt at laboratory control of butter produced in this country—assuming that the yeast and mould content is an index of the care exercised in its manufacture. The butters examined were drawn from various sources, chiefly from 56 and 28 lb. pyramid boxes, a few 1 lb. prints, and also from factory produce. It must not be understood, however, that the samples examined represented average Irish butter; as a matter of fact many of them were stored at room temperature from a week to a fortnight before plating. The samples were taken in the following manner:—a core was drawn from the centre of the box with a sterile trier and about two inches of the top and bottom were discarded. A plug of about one inch was then taken from each end and a similar one from the centre, the three being asceptically transferred to a previously sterilized 4 oz. glass jar with screw-on lid. The samples were then placed in a cold room, the temperature of which did not rise above 0° C. Before plating, the sample jar was placed in a water bath running between 40-44° C.; and was shaken a few times

until it assumed a liquid condition, the dilutions being made directly. The latter were made in sterile water held at 40-44° C., withdrawing 1 c.c. of liquid butter in a warm pipette and adding it to a 9 c.c. water blank. A further dilution of 1/100 c.c. was also made. One c.c. of each dilution was added to sterile plates for all pH values studied; the liquefied medium. at 40-44° C., was then poured in and mixed thoroughly with the inoculum by tilting and rotary motion of the plate. The plates were incubated in an inverted position for five days at 20° C.

Counting was done by placing the plate on a dark background, removing the lid and recording by hand counter all colonies visible through a 3·5 X lens. As soon as the counting was done, ten small colonies were selected for microscopical observation. This was done to determine the effect of the acidity of the medium on the development of bacteria. It should be understood that only small and doubtful colonies were selected for this examination, characteristic yeast growths being avoided.

In the first section of the work a pH range of from 4·5 to 6·5 was covered. In Table I. are given the numbers of yeast and mould colonies which developed, under the conditions mentioned, from 18 samples of butter on a wort agar medium of varying hydrogen-ion concentration. In the same table the ratio of bacterial to yeast colonies out of every ten examined is given. The *data* presented in Table I. indicate that there is very little variation in the yeast counts obtained over the pH range studied, except that there is a consistent reduction of the numbers in the region of pH 4·5 to 5·0. There was little variation in the numbers of moulds developing over the range dealt with. As a result of microscopical examination of ten selected small colonies. it was found that over the complete range there was a comparatively vigorous growth of bacteria. This was not so apparent when the pH was reduced to 4·5, but even here the inclusion of the smaller colonies in the yeast count must necessarily introduce a serious error. Taking the average ratio of bacteria to yeasts in the colonies examined, it is shown that at pH 6·5 the ratio was 8·1 to 1·9, at pH 5·5 8·5 to 1·5, at pH 5·0 7·4 to 2·6 and at 4·5 6·8 to 3·2. The observation of such a small number of colonies on each plate gave rather misleading results as to the extent of bacterial growth over the entire plate; it is not intended, therefore, to use the ratios given for the purpose of determining yeast counts. Indeed the data given show that even at a pH of 4·5 the enumeration of all visible growth on the plate gives a result which is very far from the true yeast count.

Although the results of this work clearly indicated that the very high counts which were obtained were partly due to the inclusion of bacteria, continued use was made of a wort agar medium having a pH value of 4·5 for yeast and mould counts until such time as a second investigation could be undertaken to determine the critical hydrogen-ion concentration for the elimination of bacterial growth.

In the second part of the work the same wort agar medium was employed, except that the highest pH value studied was 4·5 and the lowest 3·5, with

TABLE I.

TABLE 1.

COMPARISON OF TOTAL COLONIES DEVELOPING IN 5 DAYS AT 20°C. ON A WART AGAR MEDIUM WITH DIFFERENT HYDROGEN ION CONCENTRATIONS. ALSO RATIO OF BACTERIA TO YEASTS IN 10 DOUBTFUL COLONIES EXAMINED FROM EACH PLATE.

SAMPLE NUMBER	pH 6·5			pH 5·5			pH 5·0			pH 4·5		
	Yeasts and Bacteria	Moulds	Ratio Bacteria to Yeasts	Yeasts and Bacteria	Moulds	Ratio Bacteria to Yeasts	Yeasts and Bacteria	Moulds	Ratio Bacteria to Yeasts	Yeasts and Bacteria	Moulds	Ratio Bacteria to Yeasts
1	55,000	40	9 : 1	50,000	50	9 : 1	45,000	30	8 : 2	38,000	40	8 : 2
2	1,500	10	6 : 4	1,800	20	6 : 4	1,400	10	5 : 5	1,200	20	6 : 4
3	560	10	6 : 4	510	20	8 : 2	500	10	6 : 4	460	20	5 : 5
4	1,800	30	8 : 2	1,900	40	9 : 1	1,600	30	8 : 2	1,500	20	7 : 3
5	420	10	7 : 3	450	0	9 : 1	390	10	8 : 2	360	20	9 . 1
6	96,000	500	10 : 0	95,000	600	10 : 0	87,000	800	9 : 1	71,000	700	10 : 0
7	80	0	10 : 0	70	10	9 : 1	70	0	9 : 1	60	10	7 : 3
8	30,000	300	8 : 2	34,000	200	10 : 0	28,000	400	10 : 0	25,000	200	8 : 2
9	12,000	20	7 : 3	15,000	40	9 : 1	11,000	50	6 : 4	8,000	30	5 : 5
10	6,300	10	9 : 1	8,200	30	8 : 2	5,100	20	7 : 3	4,800	10	9 : 1
11	80,000	260	7 : 3	86,000	300	8 : 2	60,000	120	6 : 4	62,000	250	5 : 5
12	46,000	400	8 : 2	43,000	600	8 : 2	40,000	300	7 : 3	36,000	500	7 : 3
13	8,500	30	9 : 1	9,900	40	9 : 1	8,700	50	8 : 2	8.300	30	7 : 3
14	80	30	10 : 0	70	40	9 : 1	90	10	9 : 1	60	20	8 : 2
15	760	10	8 : 2	880	0	10 : 0	730	0	7 : 3	600	10	6 : 4
16	260	0	10 : 0	240	0	9 : 1	200	0	8 : 2	210	0	6 : 4
17	760	80	6 : 4	890	90	7 : 3	630	60	4 : 6	640	70	5 : 5
18	26,000	500	7 : 3	32,000	300	9 : 1	20,000	400	8 : 2	18,000	300	4 : 6
AVERAGE ...	20,334	124	8·1 : 1·9	21,106	132	8·5 : 1·5	17,245	128	7·4 : 2·6	15,343	125	6·8 : 3·2

an intermediate of 4·0. Originally it was intended to include a fourth of pH 3·0, but difficulty in getting it to solidify and the fact that 3·5 practically excluded all bacterial growth resulted in the abandonment of the proposal. On the sterilisation at 15 lbs. of wort agar of pH 3·5 a solid medium was not obtained. However, when the three media (two of which were for comparative purposes) used were made up as already described, adjusted, tubed and sterilized by intermittent steaming on three successive days, they solidified normally. Later, however, the method advocated by Hood and White (2), of acidifying to the required pH value with 5 per cent. lactic acid just before plating was found to be much more convenient, and is now adopted in the routine work at this Station. The principal reason for adhering to the pre-adjustment method was its use in the first part of the investigation, the object being to obtain comparative figures. As has just been pointed out, the pre-adjustment method is not feasible for pH values of under 3·5, and even here it is tedious.

The technique of sampling, plating, as also the time and temperature of incubation in the second part of the work were the same as that used in the first part. Dilutions of 1/10 and 1/100 were plated in all cases, except where shown; in the latter cases experience of the quality necessitated plating 1 c.c. and 1/10 c.c. As before, ten small colonies in each plate counted were selected for microscopical examination so as to ascertain the inhibitory effect of the acidity of the medium expressed in terms of hydrogen-ion concentration. This ratio does, no doubt, serve as an approximate index of the error introduced when such colonies are regarded as yeasts; and furthermore shows the fallacy of considering all small growths as bacteria. In Table II. the data are presented in the same form as in Table I.

It is obvious on examination of the figures given that the lowering of the pH value of the medium from 4·5 to 3·5 makes an enormous difference in the yeast counts obtained from the same butter-sample. Approximately, an average of 77 yeast colonies develop at 4·5 for 1 at 3·5 and 2 at 4·0, also 38 at 4·5 for 1 at 4·0 and 2 at 4·0 for 1 at 3·5. The source of these wide variations is partly elucidated by the ratios of bacteria to yeast colonies out of every ten examined. (See fourth, seventh and tenth columns.) Plating 30 samples of butter on a wort agar medium, varying the pH value and in each case examining 300 small colonies showed that (i.) when the pH value was 4·5, 234 were bacteria; the remainder were yeasts—or a ratio of 7·8 to 2·2; (ii.) when the pH value was 4·0, 75 were bacteria and 225 yeasts, a ratio of 2·5 to 7·5; and (iii.) when the pH value was 3·5, 6 were bacteria and 294 yeasts, a ratio of ·2 to 9·8. The results prove that, within the limits of experimental error, the mould count was little affected by the hydrogen-ion concentration of the medium over the range studied.

The investigation shows that unless a medium with a hydrogen-ion concentration in the region of 3·5 is used for the enumeration of yeasts, there is a great danger of including many bacterial colonies in the count. It does not follow, however, that the entire yeast flora of butter will find suitable conditions for growth in a pabulum of this acidity. The work

TABLE II.

COMPARISON OF THE TOTAL COLONIES DEVELOPING IN 5 DAYS AT 20°C. ON A WORT AGAR MEDIUM WITH DIFFERENT HYDROGEN-ION CONCENTRATIONS. ALSO RATIO OF BACTERIAL TO YEAST IN 10 DOUBTFUL COLONIES EXAMINED FROM EACH PLATE.

Sample No.	pH 4·5			pH 4·0			pH 3·5		
	Yeasts and Bacteria	Moulds	Ratio Bacteria to Yeasts	Yeasts and Bacteria	Moulds	Ratio Bacteria to Yeasts	Yeasts and Bacteria (?)	Moulds	Ratio Bacteria to Yeasts
1	7,600	10	8 : 2	280	20	3 : 7	120	10	0 : 10
2	32,000	30	6 : 4	620	20	3 : 7	460	40	0 : 10
3	86,000	80	4 : 6	2,500	90	0 : 10	1,150	70	0 : 10
4	2,100	10	9 : 1	120	20	4 : 6	40	20	1 : 9
5	7,200	50	8 : 2	130	40	2 : 8	80	60	0 : 10
6	14,200	40	7 : 3	250	50	0 : 10	170	30	0 : 10
7	30,900	70	7 : 3	760	60	3 : 7	390	80	0 : 10
8	53,700	70	8 : 2	1,920	80	2 : 8	860	90	0 : 10
9	80,000	100	5 : 5	1,620	90	0 : 10	980	70	0 : 10
10	1,360	10	9 : 1	50	0	2 : 8	20	10	0 : 10
11	16,500	50	8 : 2	320	40	4 : 6	190	60	0 : 10
12	20,800	80	7 : 3	410	70	6 : 4	230	70	0 : 10
13	2,630	30	8 : 2	50	20	0 : 10	30	10	0 : 10
14	760	0	10 : 0	30	10	3 : 7	10	0	2 : 8
15	42,600	80	9 : 1	1,180	90	0 : 10	530	100	0 : 10
16	4,100	40	10 : 0	190	30	2 : 8	50	20	0 : 10
17	2,410	30	8 : 2	60	20	3 : 7	30	10	1 : 9
18	760	0	10 : 0	30	10	3 : 7	10	0	0 : 10
19	12,400	60	8 : 2	210	50	3 : 7	90	30	0 : 10
20	13,500	70	9 : 1	280	90	0 : 10	160	100	0 : 10
21	5,100	10	9 : 1	110	10	2 : 8	70	10	0 : 10
22	163,000	300	7 : 3	3,900	400	2 : 8	2,190	450	0 : 10
23	216,000	300	8 : 2	5,800	500	5 : 5	2,700	600	0 : 10
24	4,520	20	6 : 4	120	10	2 : 8	40	10	0 : 10
25*	2,130	8	3 : 7	59	6	1 : 9	26	4	1 : 9
26*	1,510	6	9 : 1	47	4	2 : 8	19	3	0 : 10
27*	1,960	4	8 : 2	78	3	3 : 7	30	6	0 : 10
28*	3,860	10	7 : 3	122	9	2 : 8	56	8	0 : 10
29*	5,410	30	9 : 1	169	30	4 : 6	73	20	0 : 10
30*	980	14	10 : 0	39	12	8 : 2	16	10	0 : 10
Average	27,866	54	7·8 : 2·2	715	63	2·5 : 7·5	360	67	0·2 : 9·8

* 1 c.c. and 0·1 plated.

executed as indicated above practically agrees with and confirms that carried out by Hood and White (2), a report of which has just come to hand.

Summary.

1. The practical value of a yeast and mould count has been considered in its relation to the biological control of the butter-making process.
2. In the first section of the investigation data are given which show that the lowering of the pH value of a wort agar medium from 6·5 to 4·5 had very little effect on the counts under consideration. At pH 4·5 a large number of colonies which were included in the yeast count were bacteria.
3. In the second part a table is given which shows clearly that the pH value of the medium had to be reduced to the region of 3·5 before the count obtained could, with safety, be regarded as consisting entirely of yeasts.
4. The hydrogen-ion concentration does not seem to have any marked effect on the mould count over the range studied.
5. The results obtained are in agreement with recent work carried out on the same subject by Hood and White (2).

The author desires to acknowledge the helpful advice and criticism given throughout this work by Mr. A. Poole-Wilson, Senior Dairying Inspector, and Mr. P. S. Arup, Analyst, of this Station.

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REPORT ON LARGE SCALE WHEAT EXPERIMENTS, 1926-27.

These experiments were inaugurated in the season 1925-26, in which season over 280 plots of wheat totalling over 270 statute acres were grown throughout the Saorstat under the supervision of the Agricultural Instructors. A complete report on these trials was published in the Department's JOURNAL, Vol. XXVII, No. 2. The scheme was continued on somewhat similar lines in the season 1926–27. In order to provide adequate supplies of reliable and pure seed, arrangements were made to have grown in the previous season at the Albert Agricultural College, Glasnevin, a large area of the Yeoman II variety of wheat which was considered most suitable for general cultivation throughout the country. Over 230 barrels of seed of a high degree of purity and with a germination of 96 per cent. was eventually available for distribution. Each Agricultural Instructor was directed to arrange for the laying down of at least 4 plots of wheat in his district and to supervise personally all operations in connection with the growing of the crop from the sowing of the seed to the threshing and weighing of the resulting produce. Each plot was to be at least one statute acre in extent except in a few counties in the western area where, in exceptional cases, Instructors were allowed to arrange for plots of only half a statute acre. As one of the main objects of the scheme was the production and propagation of suitable supplies of seed wheat there were no restrictions as to the maximum size of the plots in any district.

In due course arrangements were made for the supply of seed at a reasonable price to plotholders at 259 centres and altogether over 570 hundredweight of seed was despatched. The size of the plots varied considerably. At a small number of centres in western counties they were only half an acre in size, whereas a number of plots were of an area of from 2 to 4 acres and at one centre in Offaly a plot of 10 acres was grown. However, at the majority of centres the plots were of one statute acre in size. The rate of seeding also varied in the different districts, but in general from 15 to 18 stone of seed per statute acre was sown.

Supplies of seed for the great majority of centres were despatched early in October, but owing to adverse weather conditions, sowing was, in a number of cases, considerably delayed. In fact, the sowing of the plots extended over the period from early October to early in March and quite a number of plots were not seeded until after the new year had set in. Owing to the lateness of sowing at a number of centres and also on account of the characteristic slowness of growth of Yeoman II variety of wheat during winter and early spring, it was decided to notify plotholders that they should not, particularly in the case of late sown or backward crops, hesitate to apply dressings of artificial manures to the crop in spring. Subsequently, at a relatively large number of centres, topdressings of sulphate of ammonia or nitrate of soda were applied to the plots in spring with apparently satisfactory results in most cases.

Of the 259 plots laid down, 27 were said to be failures. The failure of the crops at 9 centres was attributed to the depredations of rooks, rabbits and other vermin. At 12 other centres the failure was largely ascribed to the conditions of the soil at sowing time and to subsequent water logging and in nearly all of these cases, the crops were ploughed up in spring. At the six remaining centres—four in County Waterford and two in County Wexford—the germinating capacity of the seed was said to be defective. At the two centres in County Wexford the seed was allowed to become slightly heated before it was sown and no doubt this seriously impaired the germinating capacity of the grain. For some unknown reason the seed sown at the four centres in County Waterford also failed to germinate satisfactorily. In view of the fact that there were no complaints regarding the germinating capacity of the seed from the 253 remaining centres at which plots were located in other counties, this was rather surprising, more particularly as the seed supplied under the Scheme was obtained from the same bulk and stored, prior to despatch, under similar conditions.

The centres at which the crops were said to be failures due to adverse conditions of soil or climate were not confined to any particular area of the country or to any one type of soil, the twelve centres at which such failures occurred being distributed over eleven counties. It should, however, be observed that in these particular cases the crops were, with a single exception, sown later than the end of October, and at seven of the twelve centres the seed was not got in until after the beginning of December. In five of these latter cases, seeding did not take place until the New Year had set in, and at two centres the crop was not sown until February. Although relatively good returns were, in a number of cases, obtained where the crop was sown as late as January or even February, it is evident that the sowing of a variety such as Yeoman II late in the season, particularly where the soil is not in good condition, is attendant with a good deal of risk.

The crops at practically all centres at which the plants survived the winter grew vigorously during the spring and early summer months. However, the wet and sunless late summer and early autumn which followed were distinctly unfavourable to the development and maturity of good quality grain. The wet summer coupled with late sowing in a number of cases delayed ripening; the harvest being later than usual in most districts. Although the crops on the plots were not lodged to any extent the unfavourable weather which prevailed during autumn delayed harvesting operations, and in general the crops were not stored in very good condition.

Owing to the large number of plots laid down in Offaly, North Tipperary and Kilkenny, and the consequent impossibility of securing weighings of the produce at all centres, the Instructors in these particular areas were directed to restrict weighings to a maximum of ten centres. In the other counties, with the exception of Counties Louth and Monaghan, where no trials were arranged owing to the absence of Instructors, weighings of the produce were obtained from all centres where plots were laid down except at those 27 centres where the crops on the plots were described as failures.

The number of centres in each county or district at which plots were

located, the number of failures and the number of centres from which returns or weighings of the grain were obtained are shown in the following table :—

County or District.	No. of plots laid down	No. of centres where crop was described as a failure	No. of centres from which weighings were obtained
Carlow	8	3	5
Cavan	6	2	4
Clare E.	6	—	6
,, W.	7	1	6
Cork N.E.	6	—	6
,, S.E.	7	—	7
,, W.	4	—	4
Dublin	3	1	2
Donegal	5	1	4
Galway N.	4	1	3
,, S.	4	—	4
Kerry N.	5	—	5
,, S.	10	2	8
Kildare	7	1	6
Kilkenny	15	—	10
Laoighis	10	1	9
Leitrim	8	—	8
Limerick W.	4	1	3
,, E.	4	—	4
Longford	9	—	9
Mayo N.	1	—	1
,, S.	1	—	1
Meath	4	1	3
Offaly	47	—	10
Roscommon N. ...	4	1	3
,, S. ...	7	2	5
Sligo	7	1	6
Tipperary N. ...	20	—	9
,, S.	8	—	8
Waterford	5	4	1
Westmeath	7	—	7
Wexford	8	3	5
Wicklow	8	1	7
	259	27	179

As in the previous year duplicate samples of grain were secured by the Instructors, placed in separate bottles, securely sealed and forwarded to the Department's offices. Immediately after arrival one sample from each of the 176 centres from which samples were obtained was submitted to a test for moisture content in the Chief State Chemist's Department. The duplicate sample from each centre was retained for inspection and classification.

The Irish Flour Millers' Association, at the request of the Department, again very kindly undertook to arrange for three of their members—Messrs. Shackleton, Brown and Odlum—to examine and classify, in respect of milling quality, the samples from the various plots.

In the examination of the wheat, the Millers' representatives decided to follow the general procedure adopted in the previous year and to grade the samples into three classes—(A) very good, (B) average, and (C) bad. This classification or grouping referred only to the samples examined and had no special relationship with the samples inspected in the previous year or with ordinary commercial samples of wheat from the 1927 crop handled by the Millers. The Millers' representatives, however, expressed the opinion that the samples were in general above the average quality of Yeoman wheat grown in the Saorstát in 1927 and that the samples grouped in Class (B) as well as those in Class (A) were quite suitable for milling purposes.

The individual returns from the various centres at which weighings were taken, the average yield for all centres, the moisture content of the samples, and the classification or grading of the various samples examined by the representatives of the Irish Flour Millers' Association are shown in the tables on pages 214 to 222.

It is rather an extraordinary coincidence that the average yield of 23 cwt. 3 qr. per statute acre should be exactly the same as the average yield obtained in the previous year. Although the plots were, in general, located on land somewhat above the average in fertility, the average yield must be considered as satisfactory, particularly in view of the facts that the season was not very suitable for grain crops and that at almost one-third of the centres the crops were not sown until after the beginning of December, and that in more than 30 cases sowing did not take place until after the New Year had commenced. The yields at the individual centres ranged from 9 cwt. to over 43 cwt. per statute acre. At 23 centres the yield exceeded 30 cwt. of grain per acre, but at 7 centres it was below 15 cwt. However, in two or three of these latter cases the low yield was, at least to some extent, accounted for by the ravages of birds at harvesting time.

Remarkably good returns were obtained from County Clare, particularly in the eastern portion of the county, where the average yield from the six centres at which plots were located was over 30 cwt. per statute acre. On the other hand the return from South Kerry was correspondingly low, the average yield of grain from 8 centres being less than 18 cwt. per statute acre. In general, however, it was found that relatively high yields were produced at one or more centres in almost every county and it would, therefore, appear that the successful growing of wheat of the Yeoman type is influenced to a greater extent by the fertility of the soil and the manuring and cultivation accorded to the crop than by the climatic conditions peculiar to any district.

The moisture determinations made on samples drawn from 176 centres show a remarkably wide variation ranging from slightly under 15·0 per cent. to over 25·0 per cent. A summary of these returns is shown in the following table :—

2%	of the samples	contained	less than	16·0%	of water.
3%	,,	,,	from	16 to 17%	,,
18%	,,	,,	,,	17 ,, 18%	,,
37%	,,	,,	,,	18 ,, 19%	,,
22%	,,	,,	,,	19 ,, 20%	,,
9%	,,	,,	,,	20 ,, 21%	,,
9%	,,	,,	over	21·0%	,,

The average moisture content for all samples was 18·9 per cent., or almost one per cent. higher than the average for the previous season. This, however, is in no way surprising as the weather conditions at harvest time in 1926 were exceptionally good, whilst those prevailing during the period in which the 1927 crop was being harvested were unusually bad. It is quite evident, however, as a result of the two seasons' trials that, particularly in bad seasons, the high moisture content of the grain of home grown wheat presents a serious difficulty to the farmer in the handling and storing of the crop, and to the miller in the subsequent drying off of the surplus moisture.

Of the 176 samples examined and classified by the millers' representatives, 85 were grouped into Class (A), 83 in Class (B), and 8 in Class (C), therefore, over 95 per cent. of the samples were, in the opinion of the judges, suitable for milling purposes.

It was also found that first quality samples of grain were produced in almost every county in the Saorstát. These results are satisfactory, especially when it is considered that the weather which prevailed during and prior to the harvest of 1927 was unusually wet and unsuitable to the development of good quality grain. The best quality samples examined were grown in East Clare; every one of the samples from the six plots located in that district being graded as Class (A). It has already been pointed out that the average yield from these same six plots was over 30 cwt. per statute acre, and although it has been shown that the production of high yields and of good quality samples was not confined to any particular district or soil, it is evident that the conditions of soil and climate in this particular district must have been distinctly favourable to the growth and development of the wheat crop.

The following report has been submitted by Mr. E. Shackleton, Carlow, one of the millers' representatives who examined the samples.

> "As is very well known the Summer of 1927 was very cold and wet and extremely unsuitable for proper development of wheat, and the wheat samples that were shown to us from all over the Saorstát were extremely good, taking into consideration the bad season.
>
> "In my report to the Department as regards the 1926 crop which I sent on 18th January, 1927, I mentioned that the year 1926 was very favourable to wheat. 1927 was just the reverse. After seeing the samples that were submitted by the Department, and the considerable quantities of Yeoman II wheat that we received at Barrow Mills, I must say I felt very surprised to find the quality of the crop in 1927 as good as it proved.
>
> "I really feel I have very little to add to the opinions I expressed in my letter of the 18th January, 1927, except this point: that the wheat has shown great ability to resist bad weather."

Mr. Odlum, one of the Millers' Representatives, who examined the samples very kindly offered to conduct, at his own expense at Messrs. Odlum and Odlum's mills at Naas, a large scale milling test with the produce of the plots if the Department could arrange with the growers to supply at least 50 barrels of grain. Owing to the demand for the produce of the plots for seed purposes it was not found possible to secure the necessary 50 barrels within a reasonable distance of the mills at Naas. About 18 barrels were, however, obtained from plotholders in Offaly and North Tipperary.

The balance of Yeoman II required to make up the 50 barrels was purchased by Mr. Odlum from a grower in County Kildare who, although not a plotholder under the Scheme, had grown a considerable acreage of Yeoman II. wheat during the season of 1927. Mr. Odlum also made arrangements to have the properties of the flour produced in the milling test further investigated by Mr. G. S. Kirby of the Dublin Port Milling Company, and to have sample loaves baked from the flour in the Dublin Port Milling Company's

experimental bakery. Subsequently these loaves were exhibited in the Department's Educational Exhibit at the Royal Dublin Society's Spring Show, where they attracted considerable attention.

Mr. Claude Odlum submitted the following report on the milling and baking tests.

> "This wheat was quite a fair average sample, although the moisture content was greater than the average of the previous year. It was prepared for milling as follows :—
>
> "Firstly, it was dried on a tiled kiln and 5·6 per cent. of moisture was dried out, leaving the wheat to contain 14·2 per cent. moisture. This was then washed, screened, and milled in the ordinary way, and the milling yield on this dried wheat was as follows :—

Flour ...	69·7 per cent.	Tailings ...	·7 per cent.
Bran ...	17·0 ,,	Loss (Milling)	1·6 ,,
Pollard ...	11·0 ,,		———
			100·0 per cent.

> "The flour produced was quite a fair sample, but not so good as in 1926. The loaf made from yeast fermentation was fair, and the scone made by using soda and buttermilk was good, although it did not rise too well, but the flavour and colour were nice. The baking tests and the bread produced for your Department at the Royal Dublin Society's Spring Show was done by Mr. Kirby, M.Sc., of the Port Milling Company."

Plotholders under this Scheme were advised by the Department through the medium of the Agricultural Instructors to reserve the produce of their plots—if suitable—for seed purposes and to dispose of the balance not required for the seeding of their own land to farmers in their respective districts. It is understood that in most districts the bulk of the produce of the plots was utilised for seed in the subsequent season.

During the two seasons in which this scheme has been in operation plots of Yeoman and Yeoman II varieties of wheat have been successfully grown at almost 500 centres representing a total acreage of over 500 acres and, as a large proportion of the grain produced at these centres was used for seed in the subsequent seasons, it is evident that at present there are large supplies of seed of the Yeoman varieties available in the country.

Although the returns both as regards yield and quality of the grain produced by the Yeoman and Yeoman II varieties of wheat grown under this scheme of experiments during the two seasons 1926 and 1927 were on the whole satisfactory, the results from a number of centres where these varieties were grown under a somewhat similar scheme in 1928 were disappointing. Complaints of very inferior returns from these varieties were received from Co. Wexford and Co. Cork, and from a number of other districts it was reported that the Yeoman varieties had not done as well as in the previous seasons. It is therefore evident that whilst the Yeoman types of wheat may produce good crops when sown on soil in good condition they cannot be generally recommended for cultivation on all soils, and consequently it is recommended that prospective growers should consult the local Agricultural Instructor before deciding on the variety of wheat to sow on any particular soil.

County or District		Plotholder	Nature of Soil	Previous Crop	Manure applied per statute acre
'arlow	...	A. Webster, Sherwood Park, Tullow.	Heavy Loam	Mangels	None
,,	...	J. Kavanagh, Ouragh, Tullow ...	Light Loam	Potatoes	None
,,	...	Mrs. B. M. Byrne, Paulville, Tullow	Heavy Loam	Potatoes and Sugar Beet	None
,,	...	B. Finnegan, Rathvilly, ...	Loam ...	Sugar Beet	None
,,	...	J. Dawson, Canonsquarter, Tullow	Loam ...	Sugar Beet	None
,,	...	E. Doyle, Craans, Tullow ...	Peaty Loam	Sugar Beet	Top-dressed with 1 cwt. Nitrate of Soda
,,	...	M. Lawlor, Knockrue, Rathvilly	Clay Loam ...	Turnips and Mangels	do.
,,	...	T. Halligan, Grange, Tullow ...	Loam ...	Sugar Beet	None
avan	...	M. Lynch, Liselogher, Cortubber P.O.	Stony Loam	Potatoes	Top-dressed with ¾ cwt. Sulphate of Ammonia.
,,	...	R. Turner, Lislea, Stradone ...	Rather stiff Clay Loam	Potatoes	Light dressing Sul. of Ammonia in Spring
,,	...	M. McEneany, Mullahard, Shercock	Rather Stony Loam	Potatoes	20 tons farmyard manure
,	...	J. Reilly, Maudabawn, Cootehill	Loam ...	Potatoes	None
,,	...	Holy Rosary Convent, Killeshandra	Stiff Clay ...	Potatoes	None
,,	...	P. Smith, Dromearbin House, Crossdoney.	Deep Loam ...	Potatoes	None
lare E.	...	J. Hickey, Culleen, Newmarket-on-Fergus.	Medium Loam	Potatoes and Mangels	None
,,	...	T. Daly, Lismorris, Lissycasey ...	Clayey Loam	Potatoes	None
,,	...	T. Frost, Tiermaclane ...	Sandy Loam	Potatoes and Mangels	Top-dressed with farmyard manure
,,	...	P. Nagle, Rose Cottage, Tiermaclane.	Sandy Loam on rock	Potatoes and Mangels	None
,,	...	P. O'Connell, Ballyea, Tiermaclane	Medium Loam	Potatoes	None
,,	...	P. Cunneen, Mounteashel, Sixmilebridge.	Medium Loam	Potatoes and Mangels	None
lare W.	...	J. Healy, Moyerta, Carrigaholt ...	Heavy Loam, warm situation	Potatoes	None
,,	...	T. Reidy, Clooncullen, Cooraclare	Light Loam	Potatoes	None
,,	...	D. Duggan, Tarmon, Knock ...	Friable Loam	Potatoes	None
,,	...	P. Burke, Carhue, Cooraclare ...	Rich Loam ...	Potatoes	None
,,	...	G. O'Donohue, Lack West, Kilmihil.	Rich friable Loam.	Potatoes	None
,,	...	T. Keane, Clonreddan, Cooraclare	Medium Loam	Potatoes	1 cwt. Sulphate of Ammonia in Spring
,,	...	P. Keane, Lisheen, Kilkee ...	Cold Heavy Loam	Potatoes	None
ork N.E.	...	Miss M. M. S. Greene, Airhill, Glanworth.	Medium Loam on Limestone	Potatoes	None
,,	...	J. Hickey, Inchinapalace, Ballyhooly.	Medium Lime-Loam.	Potatoes	None
,,	...	J. Walsh, Lahern, Doneraile ...	Clay Loam on Limestone	Potatoes	1 cwt. Nitrate of Soda
,,	...	P. H. Barry, Ballyellis, Buttevant	Medium Loam on Limestone	Potatoes	None
,,	...	J. W. Fahy, Mount Ruby, Mallow	Clay Loam (Sandstone)	Potatoes	None
,,	...	J. Quinlan, Ardglare, Mitchelstown	Medium Loam (Sandstone)	Potatoes	None
'ork S.E.	...	P. Power, Knockglass, Ladysbridge	Medium Sandstone Loam	Potatoes	None
,,	...	J. Griffin, Castlemartyr ...	Medium Loam	Potatoes	None
,,	...	J. Egan, Monagurra, Shanagarry	Medium Loam	Potatoes	None
,,	...	M. Smiddy, Ballymadog, Youghal	Sandy Loam	Potatoes	None
,,	...	J. O'Brien, Clonard, Youghal ...	Sandy Loam	Potatoes	2 cwt. Semsol and 2 cwt. Super.

EXPERIMENTS, 1926–27.

Date of Sowing	Date of Harvesting	Yield per Statute Acre T.	C.	Q.	Percentage of moisture in Sample	Classification of Sample	OBSERVATIONS
7 Feb., 1927	—	—	—	—	—	—	Brairded thinly. Damaged by rooks and had to be reseeded with Oats.
15 Nov., 1926	6 Sept., 1927	1	—	—	18·59	B.	
25 Jan., 1927	—	—	—	—	—	—	Failed, due to damage by rooks and adverse weather conditions.
10 Feb., 1927	—	—	—	—	—	—	Failed, due to continued unfavourable weather conditions.
18 Novr., 1926	9 Sept., 1927	1	5	2½	18·05	A.	
16 Mar., 1927	29 Sept., 1927	0	15	3½	21·03	B.	Brairded thinly, but improved under treatment.
16 Feb., 1927	11 Oct., 1927	0	10	2½	19·12	C.	Brairded thinly and irregularly, and was late in ripening.
19 Feb., 1927	8 Sept., 1927	1	0	1	19·13	A.	
26 Novr., 1926	—	—	—	—	—	—	Failure, due to adverse weather conditions.
10 Jan., 1927	2 Sept., 1927	1	5	0	18·84	A.	"Scalded" in one portion of plot due to wet.
31 Dec., 1926	14 Sept., 1927	1	6	3	19·40	B.	
29 Nov., 1926	12 Sept., 1927	0	9	2	20·54	B.	Crop grew patchy and thin, and was backward all through.
25 Novr., 1926	22 Sept., 1927	0	16	0	21·79	A.	Crop very thin. Scalded in parts due to wet.
4 Feb., 1927	—	—	—	—	—	—	Failed, due to adverse weather conditions and damage by rooks.
25 Novr., 1926	17 Aug., 1927	2	3	2	18·57	A.	
3 Novr., 1926	19 Aug., 1927	1	15	3	18·68	A.	
13 Dec., 1926	25 Aug., 1927	1	13	3	17·74	A.	
8 Dec., 1926	23 Aug., 1927	1	0	0	18·22	A.	Soil only a few inches deep resting on rock.
1 Dec., 1926	22 Aug., 1927	1	10	3	19·66	A.	
21 Dec., 1926	14 Sept., 1927	0	19	1	17·85	A.	Partial failure due to being sown under adverse weather conditions
27 Oct., 1926	30 Aug., 1927	1	9	0	18·24	B.	
27 Oct., 1926	31 Aug., 1927	1	1	2	20·10	B.	Brairded thinly, due to exposed position.
27 Oct., 1926	29 Aug., 1927	1	2	3	19·25	B.	Suffered somewhat from adverse weather conditions.
21 Oct., 1926	31 Aug., 1927	1	8	3	19·08	B.	
25 Novr., 1926	2 Sept., 1927	1	9	1	17·91	B.	
20 Oct., 1926	19 Aug., 1927	1	13	0	16·92	B.	Thin in Spring, but improved wonderfully on being dressed with Sulphate of Ammonia and harrowed and rolled.
27 Oct., 1926	—	—	—	—	—	—	Failure, due to exposed situation and nature of soil.
8 Novr., 1926	20 Aug., 1927	1	2	2	19·45	B.	
28 Oct., 1926	19 Aug., 1927	1	1	1	18·43	A.	
19 Nov., 1926	23 Aug., 1927	1	2	1	20·27	A.	
4 Nov., 1926	16 Aug., 1927	1	4	1	18·34	A.	
4 Nov., 1926	14 Aug., 1927	1	5	0	17·01	B.	
27 Oct., 1926	20 Aug., 1927	1	3	0	18·23	B.	
20 Dec., 1926	16 Aug., 1927	1	7	3	19·74	A.	
1 Feb., 1927	17 Aug., 1927	0	18	0	19·47	B.	Yield reduced, due to damage by birds.
7 Jan., 1927	18 Aug., 1927	1	4	0	21·88	B.	Damaged by exposure during harvest operations.
7 Jan., 1927	17 Aug., 1927	1	1	0	18·48	B.	
4 Jan., 1927	16 Aug., 1927	1	8	0	19·71	A.	

Large Scale Wheat Experiments,

County or District	Plotholder	Nature of Soil	Previous Crop	Manure applied per statute acre
Cork S.E. ...	D. Parker, Ballyrobin, Cloyne ...	Medium Sandstone Loam.	Potatoes	None
,, ...	D. Dunne, Castlemartyr ...	Sandy Loam	Potatoes	None
Cork W. ...	R. J. Donovan, Drinagh, Dunmanway.	Sandy Loam	Potatoes	None
,, ...	D. P. Crowley, Drinagh E., Dunmanway.	Light Loam	Potatoes	None
,, ...	M. F. Scully, Ardfield, Clonakilty	Sandy Loam	Potatoes	None
,, ...	T. Ross, Cahirdaniel, Bantry ...	Stiff Clay ...	Potatoes	None
Donegal ...	W. F. McCormick, Castlefin ...	Heavy Loam	Potatoes	1 cwt. Sulphate of Ammonia.
,, ...	W. Doherty, Cashel, Glenealy ...	Medium Loam	Potatoes	None
,, ...	W. McConnell, Cainshanagh, Raphoe.	Sandy Loam	Potatoes	1 cwt. Sulphate of Ammonia.
,, ...	J. O'Flaherty, Carrick, Castlefin	Deep Medium Loam	Potatoes	None
,, ...	Mrs. M. A. Weir, Tannawood, Ballindrait.	Medium Loam	Potatoes	1 cwt. Sulphate of Ammonia.
Dublin ...	J. Hoey, Mountain View, Mulhuddart.	Clay Loam ...	Potatoes	None
,, ...	J. Kettle, Loverswood, Swords...	Clay Loam ...	Potatoes	None
,, ...	M. Sheridan, Bealinstown, Swords	———	———	———
Galway N. ...	R. Walsh, Tulrush, Belclare ...	Light Limestone Loam	Potatoes	None
,, ...	P. Mannion, Kilcreevanty, Tuam	Clay Loam ...	Potatoes	None
,, ...	T. Hession, Ballydoty, Belclare	Light Loam	Potatoes	3 cwt. mixture of artificials.
,, ...	Agricultural College, Mount Bellew	Deep Clay Loam	Turnips	1 cwt. Nitrate of Soda
Galway S. ...	J. Keane, Cootheen, Loughrea ...	Rich Limestone Loam.	Potatoes	4 cwt. "High Class Special."
,, ...	T. Hynes, Shra, Craughwell ...	Medium Limestone Loam	Potatoes	4 cwt. Super. 35%
,, ...	M. Reddin, Curra, Kilreacle ...	Strong Loam	Potatoes	4 cwt. Super. 35%
,, ...	P. Mullaville, Coorheen, Loughrea	Rich Limestone Loam.	Potatoes	4 cwt. Super. ...
Kerry N. ...	F. Harty, Ballybroman House, Ardfert	Strong Loam	Potatoes	1 cwt. Nitrate of Soda
,, ...	P. Lyons, Ballintoher, Lixnaw	Strong gravelly Loam.	Potatoes	1 cwt. Nitrate of Soda
,, ...	E. Horgan, Gortnaskehy, Ballybunion.	Strong Loam	Potatoes	1 cwt. Nitrate of Soda
,, ...	M. O'Connell, Rathmorrell, Causeway.	Deep gravelly Loam.	Potatoes	1 cwt. Nitrate of Soda
,, ...	T. Fitzgerald, Aulane, Abbeydorney.	Medium Loam	Potatoes	1 cwt. Nit. of Soda; 3 cwt. Super. (35%); 2 cwt. Kainit.
Kerry S. ...	D. Counihan, Faha, Beaufort ...	Medium Loam	Potatoes	¾ cwt. Sulphate of Ammonia.
,, ...	W. Langford, Nauntenaune, Killorglin.	Medium Loam	Potatoes	None
,, ...	E. O'Keeffe, Lissivigeen, Killarney	Medium Loam	Potatoes	None
,, ...	J. J. Doyle, Whitefield, Beaufort	Medium Loam	Potatoes	None
,, ...	R. Langford, Callinafercy, Milltown.	Medium Loam	Potatoes	None
,, ...	T. Sullivan, Faha, Beaufort ...	Medium Loam	Potatoes	None
,, ...	J. Pigott, Rathcomane, Ballyhar	Medium Loam	Potatoes	None
,, ...	R. B. Reynolds, Faha, Beaufort	Clayey Loam	Potatoes	None
,, ...	C. O'Connor, Faha, Beaufort ...	Medium Loam	Potatoes	None
,, ...	N. P. Tangney, Listry, Beaufort	Medium Loam	Potatoes	None
Kildare ...	J. O'Connor, Elm Hall, Celbridge	Deep Loam ...	Potatoes	None
,, ...	T. Harris, Caragh, Naas ...	Clay Loam ...	Potatoes	4 cwt. Potassic Super. in February
,, ...	T. Flood, Newhall, Naas ...	Deep Loam ...	Mangels	None
,, ...	B. Weld, Somerton, Naas ...	Deep Loam ...	Potatoes	None
,, ...	E. Moran, Ballysax, Curragh ...	Medium Loam	Turnips	None
,, ...	M. Cox, Windgates, Celbridge ...	Clay Loam ...	Potatoes	None
,, ...	T. McCormack, Halverstown, Naas	Heavy Loam	Potatoes	None

1926–27—(*continued*).

Date of Sowing	Date of Harvesting	Yield per Statute Acre T.	C.	Q.	Percentage of moisture in Sample	Classification of Sample	Observations
24 Dec., 1926	19 Aug. 1927	1	7	2	20·34	A.	
4 Jan., 1927 ·	16 Aug., 1927	1	8	3	18·81	B.	
29 Novr., 1926	22 Aug., 1927	1	0	2	18·87	B.	Portion of Crop lodged early i season.
25 Novr., 1926	23 Aug., 1927	—	19	2	18·86	B.	
15 Novr., 1926	16 Aug., 1927	1	4	2	18·91	B.	
29 Novr., 1926	26 Aug., 1927	—	18	—	18·79	B.	Crop very thin, due to damage b birds.
6 Novr., 1926	16 Sept., 1927	1	1	0	18·25	A.	
30 Oct., 1926	22 Sept., 1927	—	19	2	18·27	A.	
27 Oct., 1926	10 Sept., 1927	—	18	2	18·63	A.	
25 Oct., 1926	——	—	—	—	—	—	Failure, due to damage by bird rabbits, etc.
8 Novr., 1926	16 Sept., 1927	—	18	3	21·58	B.	Reduced in yield, due to being bad harvested.
28 Novr., 1926	24 Aug., 1927	1	19	2	20·89	B.	
23 Novr., 1926	18 Aug., 1927	1	11	3	17·87	B.	
——	——	—	—	—	—	—	Failure. No results forwarded.
25 Novr., 1926	26 Aug., 1927	—	17	2	18·98	B.	
20 Novr., 1926	27 Aug., 1927	—	19	—	19·54	A.	
8 Novr., 1926	24 Aug., 1927	—	16	3	18·90	A.	
9 Dec., 1926 ·	31 Aug., 1927	—	—	—	16·36	B.	Partial failure. No return furnishe
26 Novr., 1926	21 Aug., 1927	1	2	2	19·33	A.	
26 Novr., 1926	20 Aug., 1927	1	—	—	18·44	B.	
— Novr., 1926	22 Aug., 1927	1	1	—	19·96	C.	
— Novr., 1926	21 Aug., 1927	1	—	2	19·45	A.	
7 Feb., 1927 ·	26 Aug., 1927	1	2	2	17·14	A.	
23 Oct., 1926	11 Aug., 1927	1	12	3	17·55	A.	
23 Oct., 1926	17 Aug., 1927	1	7	0½	17·52	A.	
28 Oct., 1926	17 Aug., 1927	1	9	0½	16·52	A.	
23 Oct., 1926	18 Aug., 1927	—	15	1	16·58	B.	Affected by heavy rains, grou being flat and subsoil retentiv
26 Oct., 1926	4 Sept., 1927	—	15	2	15·28	B.	
10 Feb., 1927	4 Sept., 1927	1	1	2	16·93	A.	
14 Novr., 1926	3 Sept., 1927	—	16	—	17·84	B.	
20 Oct., 1926	18 Aug., 1927	—	17	—	17·78	A.	
26 Oct., 1926	20 Aug., 1927	—	16	2	17·19	A.	
30 Oct., 1926	14 Aug., 1927	1	1	1	14·88	A.	
20 Oct., 1926	12 Aug., 1927	—	19	—	17·94	A.	
29 Oct., 1926	25 Aug., 1927	—	14	2	17·53	A.	
Feb., 1927 ·	——	—	—	—	—	—	Failure. No return furnished.
Oct., 1926 ·	——	—	—	—	—	—	Failure, brairded badly and damag by birds.
3 Novr., 1926	24 Aug., 1927	1	6	1	17·46	B.	
29 Oct., 1926	29 Aug., 1927	1	14	—	21·60	B.	Looked thin until after applicati of manure.
25 Oct., 1926	27 Aug., 1927	1	—	2	18·64	B.	Somewhat thin, due to water lyi on field.
3 Dec., 1926 ·	5 Sept., 1927	1	9	3	22·00	B.	
27 Oct., 1926	18 Aug., 1927	—	16	2	17·91	A.	
27 Oct., 1926	1 Sept., 1927	1	3	1	18·79	B.	
7 Jan., 1927 ·	——	—	—	—	—	—	Failure, due to adverse weath conditions.

Large Scale Wheat Experiments.

County or District	Plotholder	Nature of Soil	Previous Crop	Manure applied per statute acre
Kilkenny ...	G. Brennan, Ballycomey, Castlecomer.	Medium Loam	Potatoes	1 cwt. Sulph. of Ammonia, Super. 2.cwts.
,, ...	M. Hurley, Bamford, Kilkenny ...	Medium Loam	Potatoes	None
,, ...	P. Landy, Butlerwood, Windgap	Medium Loam	Mangels	1 cwt. Sulph. of Ammonia
,, ...	W. Donegan, Troyswood, Kilkenny	Sandy Loam	Barley	4 cwt. Potassic Super.
,, ...	P. Murray, Roscon, Windgate ...	Medium Loam	Potatoes	None
,, ...	M. Whelan, Grove, Dunbell ...	Medium Loam	Potatoes	None
,, ...	T. Nolan, Outrath	Sandy Loam	Barley (2nd lea)	1 cwt. Sulphate of Ammonia, 3 cwt. Super., 2 cwt. Kainit
,, ...	J. Bryan, Dunbell	Sandy Loam	Barley (2nd (lea)	do.
,, ...	N. Hughes, Bailief, Woodsgift ...	Medium Loam	Potatoes	None
,, ...	J. Walsh, Ballinalina, Kilkenny	Medium Loam	Barley (2nd lea)	None
Laoighis ...	J. Kenna, Pallas, Portlaoighise	Medium Loam	Oats after Sugar Beet	Sulphate of Ammonia
,, ...	J. Maher, Woodview, Portarlington	Loam ...	Sugar Beet	None
,, ...	A. Claxton, Dysart, Stradbally...	Light Loam	Potatoes	None
,, ...	J. W. Hutchinson, Coolbanagher	Loam ...	Potatoes	8-10 tons farmyard manure ploughed in
,, ...	T. Gowing, Kilminchy, Portlaoighise.	Light Loam	Mangels	Nitrate of Soda in Spring.
,, ...	P. J. Gorry, Kilcavan, Geashill	Clay Loam ...	Potatoes	None
,, ...	J. Lalor, Eyre, Portlaoighise ...	Light Loam	Sugar Beet	None. Sugar Beet leaves ploughed in
,, ...	J. Dowling, Derrydavy, Mountmellick.	Light Loam	Sugar Beet	None
,, ...	L. Campion, Clonmeen S. Rathdowney.	Peaty Loam	Mangels after Beet.	None
,, ...	L. Shiel, Cuffsboro' Ballacolla ...	Clay Loam ...	Mangels	½-cwt. Nitrate of Soda in Spring.
Leitrim ...	J. J. Maguire, Coroneary, Aughavass.	Heavy Peat	Potatoes	None
,, ...	P. McNabola, Taish, Drumsna ...	Clay Loam ...	Potatoes	None
,, ...	J. Moran, Farnagh, Carrick ...	Clay Loam ...	Potatoes	None
,, ...	M. Toole, Drumkeerin, Carrick...	Heavy Clay	Potatoes	None
,, ...	T. Carty, Errew, Carrigallen ...	Clay Loam ...	Sugar Beet	None
,, ...	J. McManus, Beaghmore, Carrigallen.	Heavy Clay	Potatoes	None
,, ...	B. Dolan, Antfield, Annaduff ...	Clay Loam ...	Potatoes	None
,, ...	J. Flynn, Fahymore, Carrick-on-Shannon.	Clay Loam ...	Potatoes	None
Limerick, East	J. Fitzgerald, Tobernea, Elfin ...	Heavy Loam	Potatoes	None
,, ...	A. Burke, Kilmihill, Kilmallock	Gravelly ...	Roots	None
,, ...	C. Dalton, The Hill, Kilmallock	Loam ...	Potatoes	None
,, ...	E. Ryan, Knockanerra, Murroe	Light Loam	Potatoes	1 cwt. Nitrate of Soda
Limerick, W.	J. J. O'Donnell, Ballynine, Kildimo.	Limestone Loam	Mangels and Potatoes	None
,, ...	D. O'Sullivan, Kiltanna, Knockaderry.	Sandstone Loam	Potatoes	None
,, ...	P. Harnett, Cragg, Mt. Collins ...	Sandstone Loam	Potatoes	1 cwt. Nitrate of Soda in April.
,, ...	P. J. Lynch, Dromahir House, Pallaskenry.	Limestone Loam	Potatoes	None
Longford ...	B. Drake, Dring, Granard ...	Heavy Loam	Potatoes	None
,, ...	J. Leavy, Clonahard, Longford	Limestone Soil (Heavy)	Potatoes	None
,, ...	P. Kenny, Rath Lodge, Abbeyshrule.	Moor ...	Mangels	None
,, ...	W. Heaney, Lisanure, Edgeworthstown.	Medium Loam	Potatoes	None
,, ...	Capt. W. L. Bond, Newtownbond, Longford.	Medium Loam	Potatoes	None
,, ...	T. Major, Williamstown, Longford	Heavy Loam	Potatoes	None

1926–27—(*continued*).

Date of Sowing	Date of Harvesting	Yield per Statute Acre			Percentage of moisture in Sample	Classification of Sample	Observations
		T.	C.	Q.			
15 Oct., 1926	20 Aug., 1927	1	8	1	22·37	B.	
29 Oct., 1926	19 Aug., 1927	1	5	0	18·85	B.	
15 Novr., 1926	24 Aug., 1927	1	3	3	21·20	B.	
15 Oct., 1926	19 Aug., 1927	1	2	2	19·80	A.	
11 Novr., 1926	30 Aug., 1927	1	5	2	18·96	C.	
10 Novr., 1926	27 Aug., 1927	1	1	1	19·29	B.	
5 Novr., 1926	24 Aug., 1927	1	—	—	—	—	Delicate at first, but improved o being manured.
22 Oct., 1926	1 Sept., 1927	—	18	3	18·66	B.	Do.
28 Oct., 1926	27 Aug., 1927	—	17	2	20·59	A.	Yield reduced, due to damage b birds, etc.
12 Novr., 1926	18 Aug., 1927	—	17	2	18·83	A.	
20 Dec., 1926	11 Sept., 1927	1	2	1	19·86	B.	
— Novr., 1926	8 Sept., 1927	—	17	2	—	—	Not threshed in time to forwar sample.
24 Novr., 1926	——	—	—	—	—	—	Damaged by rooks and rabbits Had to be ploughed up.
14 Novr., 1926	13 Sept., 1927	1	5	1	17·10	B.	
26 Oct., 1926	29 Aug., 1927	1	5	3	20·68	A.	
28 Novr., 1926	17 Sept., 1927	1	1	2	19·42	C.	
13 Dec., 1926	11 Sept., 1921	1	—	—	20·13	C.	
14 Dec., 1926	8 Sept., 1927	—	14	2	20·07	A.	
28 Novr., 1926	10 Sept., 1927	1	2	3	18·72	B.	Portion of crop destroyed by water logging during winter.
17 Dec., 1926	12 Sept., 1927	—	19	—	18·34	A.	
9 Novr., 1926	8 Sept., 1927	—	18	2	18·30	A.	
26 Oct., 1926	28 Aug., 1927	1	1	—	17·69	B.	
3 Novr., 1926	2 Sept., 1927	1	4	—	19·16	B.	
2 Novr., 1926	5 Sept., 1927	1	2	2	19·68	B.	
5 Novr., 1926	29 Aug., 1927	—	16	—	20·86	B.	Damaged by crows.
28 Oct., 1926	End of Aug., 1927.	—	18	—	19·28	B.	
End of Oct., 1926.	1st week of Sept., 1927.	1	1	—	21·02	B.	
5 Novr., 1926	30 Aug., 1927	1	2	—	18·44	A.	
Early Nov. 1926	Mid. Aug., 1927	1	5	—	18·58	B.	
Nov., 1926	Mid. Aug., 1927	1	4	1	19·28	B.	
Late Oct., 1926	Mid. Aug., 1927	1	6	1	19·03	B.	
Early Dec. 1926	End Aug., 1927	1	3	—	18·80	B.	
9 Dec., 1926	19 Aug., 1927	—	18	2	17·15	A.	
14 Jan., 1927	24 Aug., 1927	—	16	1	16·22	A.	
9 Feb., 1927	2 Sept., 1927	1	1	—	21·95	A.	
14 Dec., 1926	——	—	—	—	—	—	Failure. Ploughed up in Spring.
30 Oct., 1926	3 Sept., 1927	1	14	—	15·71	B.	
29 Oct., 1926	29 Aug., 1927	1	2	—	18·02	C.	
3 Jan., 1926	9 Sept., 1927	1	8	—	21·21	B.	
28 Oct., 1926	26 Aug., 1927	1	18	—	18·62	A.	
22 Feb., 1927	10 Sept., 1927	—	19	—	25·82	B.	
4 Novr., 1926	5 Sept., 1927	1	1	2	19·30	A.	Yield reduced, due to unfavourabl weather conditions.

Large Scale Wheat Experiments.

County or District	Plotholder	Nature of Soil	Previous Crop	Manure applied per statute acre
ongford ...	J. Kenny, Gurteenboy, Killashee	Heavy Loam	Potatoes	None
,, ...	O. Cunningham, Aughacordrinan, Aughnacliffe.	Medium Loam	Potatoes	None
,, ...	J. Grealy, Lehery, Lanesboro' ...	Medium Loam	Potatoes	None
ayo ...	E. McCormick, Summerhill; Killala	Medium Loam	Potatoes	None
,, ...	M. Mellett, Prospect, Claremorris	Loam ...	Oats	None
eath ...	R. Gregan, Bennettstown, Dunboyne.	Clay Loam ...	Potatoes	None
,, ...	D. Kenny, Tullameaden, Warrenstown.	Gravelly Loam	Potatoes	None
,, ...	M. Clarke, Bohermeen, Navan ...	Clay Loam ...	Potatoes, Roots	None
,, ...	T. Curtis, Wilkinstown, Ratoath	——	——	——
ffaly ...	T. Camon, Ballygowan, Cloghan	Loam ...	Potatoes	1 cwt. Sulphate of Ammonia.
,, ...	P. Cantwell, Rahan, Tullamore	Sandy Loam	Turnips	None
,, ...	S. Mounsey, Beechill, Tullamore	Medium Loam	Potatoes	None
,, ...	M. Hanlon, Ballycowan, Tullamore	Stiff Clay ...	Sugar Beet	None
,, ...	B. Caulfield, Ballyduff, Tullamore	Loam ...	Potatoes	None
,, ...	J. Doyle, Kildangan, Tullamore	Sandy Loam	Sugar Beet	$\frac{3}{4}$-cwt. Nitrate of Soda
,, ...	J. Minnock, Rahan, Tullamore	Strong Loam	Turnips	1 cwt. Sulphate of Ammonia.
,, ...	J. Gleeson, Ballyfarrell, Bluebell	Sandy Loam	Potatoes	1 cwt. Sulphate of Ammonia.
,, ...	R. Telford, Durrow, Tullamore	Strong Loam	Potatoes	1 cwt. Sulphate of Ammonia.
,, ...	J. Hogan, Ballindarra, Birr ...	Strong Loam	Potatoes	1 cwt. Sulphate of Ammonia.
oscommon ...	M. Cummins, Kiltoom, Athlone ...	Limestone Clay Loam	Potatoes (lea)	1 cwt. Sulphate of Ammonia in March
,, ...	T. Dillon, Sragh, Knockcroghery	Medium Light Clay Soil	Potatoes	1 cwt. Sulphate of Ammonia in March
,, ...	L. Harrison, Brideswell, Athlone	Medium Clay Limestone	Potatoes	1 cwt. Nitrate of Soda in April.
,, ...	T. J. Clarke, Magheraboy, Ballaghaderoen.	Medium Loam	Potatoes	None
,, ...	J. Drury, Ardsallagh, Boyle ...	Sandy Loam	Potatoes	None
,, ...	W. Phair, Rampark, Castlerea ...	Medium Loam	Potatoes	None
,, ...	T. Beirne, Kilmacumfsey, Elphin	Medium Loam	Potatoes	None
,, ...	J. McManus, Drum, Athlone ...	Medium Clay Loam	Turnips	1 cwt. Sulphate of Ammonia in March
,, ...	J. Scally, Golliagh, Lanesboro' ...	Medium Clay	Mangels and Potatoes	None
,, ...	R. O'Brien, Kiltoom, Athlone ...	Heavy Clay	Mangels and Potatoes	None
,, ...	E. Hayden, Ballymacurley, Roscommon.	Heavy Clay	Potatoes	None
ligo ...	J. McGowan, Ballygilgin, Carney	Heavy Loam	Potatoes	1 cwt. Sul. Ammonia, 2 Super., 2 Kainit.
,, ...	Sir J. Gore-Booth, Lissadell ...	Sandy Loam	Potatoes	None
,, ...	Mrs. H. Cryan, Seefin, Boyle ...	Medium Loam	Potatoes	None
,, ...	M. Keighron, Beanfield, Kilmacowen.	Medium Loam	Potatoes	None
,, ...	T. Kivelehan, Lr. Rosses, Rosses Point.	Medium Loam	Potatoes	None
,, ...	M. Kivelehan, Belra, Coolaney ...	Medium Loam	Potatoes	None
,, ...	Cooper Siggins, Clougheur, Cloughboley.	Medium Loam	Potatoes	None
pperary N.R.	G. Dunne, Dromakeenan, Roscrea	Sandy Loam	Turnips (lea)	None
,,	J. Thompson, High Park, Roscrea	Red Clay Loam	Mangels	None
,,	Ed. Kennedy, Lisladeen, Templetuohy.	Medium Loam	Beet	None
,,	J. Hayes, Killenaule, Birr ...	Medium Loam	Potatoes	None
,,	T. Boylan, Croghan, Birr ...	Black Loam	Potatoes	1 cwt. Sul. Ammonia. 2 cwt. Super.

1926–27—(*continued*).

Date of Sowing	Date of Harvesting	Yield per Statute Acre			Percentage of moisture in Sample	Classification of Sample	OBSERVATIONS
		T.	C.	Q.			
3 Novr., 1926	4 Sept., 1927	1	4	2	18·78	A.	
2 Novr., 1926	3 Sept., 1927	—	18	—	18·73	B.	Yield reduced, due to damage by crows.
29 Oct., 1926	28 Sept., 1927	1	5	—	17·92	A.	
4 Novr., 1926	3 Sept., 1927	—	19	1	18·70	A.	
3 Novr., 1926	1 Sept., 1927	1	—	1	18·91	A.	
5 Novr., 1926	18 Aug., 1927	1	4	3	17·73	A.	Yield reduced on portion of plot due to "scalding."
5 Jan., 1927	4 Sept., 1927	1	15	1	22·84	B.	
3 Novr., 1926	20 Aug., 1927	1	14	3	20·06	A.	
Jan., 1927	—	—	—	—	—	—	Seed rotted, due to saturation by heavy rains.
2 Dec., 1926	1 Sept., 1927	1	10	—	17·67	A.	
11 Feb., 1927	2 Sept., 1927	1	16	1	21·15	A.	
26 Novr., 1926	1 Sept., 1927	1	3	3	18·20	B.	
8 Feb., 1927	10 Sept., 1927	1	3	3	18·14	A.	
7 Mar., 1927	19 Sept., 1927	1	10	—	21·33	B.	
3 Jan., 1927	8 Sept., 1927	1	6	1	18·12	A.	
17 Dec., 1926	30 Aug., 1927	1	7	2	19·45	A.	
20 Novr., 1926	31 Aug., 1927	—	16	1	18·53	B.	Partial failure, due to damage by rooks.
7 Dec., 1926	29 Aug., 1927	1	9	2	19·05	A.	
2 Dec., 1926	1 Sept., 1927	1	12	2	—	—	
2 Dec., 1926	9 Sept., 1927	1	5	—	18·26	A.	
9 Novr., 1926	30 Aug., 1927	1	4	3	18·61	B.	
11 Novr., 1926	31 Aug., 1927	1	3	3	20·92	B.	
29 Oct., 1926	3 Sept., 1927	1	4	0½	18·74	A.	
23 Dec., 1926	2 Sept., 1927	1	3	2½	18·57	A.	
3 Novr., 1926	1 Sept., 1927	—	10	2	19·33	A.	Yield reduced, due to damage by crows.
Novr., 1926	—	—	—	—	—	—	Failure, due to damage by birds.
27 Novr., 1926	30 Aug., 1927	1	7	—	18·55	B.	
9 Novr., 1926	31 Aug., 1927	1	1	—	19·78	B.	
22 Novr., 1926	—	—	—	—	—	—	Failed, owing to adverse weather conditions.
13 Novr., 1926	—	—	—	—	—	—	Do.
8 Oct., 1926	17 Aug., 1927	1	15	2	17·85	A.	
—	—	—	—	—	—	—	Failed, owing to destruction by vermin.
5 Jan., 1927	28 Aug., 1927	1	1	3	19·10	A.	
5 Novr., 1926	26 Aug., 1927	1	3	2	19·70	A.	
7 Feb., 1927	30 Aug., 1927	1	1	1	18·59	A.	
20 Dec., 1926	25 Aug., 1927	1	2	1	19·81	B.	
26 Oct., 1926	20 Aug., 1927	1	3	2	17·85	A.	
1 Dec., 1926	27 Aug., 1927	1	10	2	17·71	B.	
9 Dec., 1926	23 Aug., 1927	1	13	—	19·02	A.	Damaged to some extent by crows after sowing.
3 and 11 Dec., 1926.	25 Aug., 1927	1	3	1	18·52	B.	Small wheat not included in recorded yield.
10 Dec., 1926	17 Sept., 1927	1	7	2	19·32	B.	
4 Dec., 1926	20 Sept., 1927	1	3	2	17·96	A.	

Large Scale Wheat Experiments,

County or District	Plotholder	Nature of Soil	Previous Crop	Manure applied per statute acre
Tipperary N.R.	T. Ryan, Gurteenbarna, Borrisoleigh.	Sandy Loam	Potatoes	Nitrate of Soda in Spring.
„	W. Kennedy, Lisladeen, Templetuohy.	Clay Loam ...	Beet	None
„	J. Harty, Longhaun, Cloughjordan	Clay Loam ...	Potatoes	None
„	G. Clarke, Knockane, Toomevara	Light Sandy Loam	Potatoes	1 cwt. Sulphate Ammonia. 4 cwt. Super.
Tipperary S.R.	J. Mulcahy, Drumdeel, Fethard	Heavy Clay	Potatoes	None
„	C. Purcell, Orchardstown, Clonmel	Heavy Clay	Potatoes	None
„	J. Heffernan, Cucoo Hill, Cahir ...	Heavy Clay	Potatoes	¾-cwt. Sulph. Ammonia in March.
„	T. Hackett, Glenbawn, Clonmel	Medium Clay	Potatoes	¾-cwt. Sulph. Ammonia in March.
„	J. Hunt, Lisronagh, Clonmel ...	Medium Clay	Potatoes	None
„	T. Long, Brownbog, Bansha ...	Medium Clay	Potatoes	None
„	J. Heffernan, Knockelly, Fethard	Heavy Clay	Potatoes	¾-cwt. Sulp. Ammonia in March.
„	J. McCraith, Ballyboy, Clogheen	Medium Clay	Potatoes	None
Waterford ...	W. Spratt, Grange, Youghal ...	Medium Red Sandstone Loam	Mangels	None
„ ...	N. Connors, Park, Stradbally ...	Free working old Red Sandstone.	Sugar Beet	None
„ ...	T. Walsh, Ballykervogue, Stradbally.	Shingly Red Sandstone.	Sugar Beet	None
„ ...	Mrs. W. Morrissey, Ballinasheagh, Dungarvan.	Deep, rich, Drift Loam	Sugar Beet	None
„ ...	J. O'Keeffe, Lisnakill, Butlerstown.	Strong, Red Sandstone Loam	Potatoes	None
Westmeath ...	Ml. Carey, Dalystown, Mullingar	Heavy Loam	Potatoes	None
„ ...	P. L'Estrange, Dysart, Mullingar	Medium Loam	Potatoes	None
„ ...	M. Clavin, Killeenbrack, Streamstown.	Light Loam	Potatoes	None
„ ...	M. Clarke, Cluntytallon, Kilbride	Medium Loam	Potatoes	None
„ ...	J. Lawrence, Sidebrook, Rochfortbridge.	Medium Loam	Potatoes	None
„ ...	W. Carey, Oldtown, Rochfortbridge.	Medium Loam	Potatoes	None
„ ...	J. Casey, Clonmoyle, Mullingar	Heavy Loam	Potatoes	None
Wexford ...	M. Heneghan, Kilnamock, Campile	Heavy Clay	Potatoes	None
„ ...	J. Hall, Tobergal, Boolavogue, Ferns.	Shingly Loam	Potatoes	None
„ ...	P. Behan, Ballymotebeg, Enniscorthy.	Shingly Loam	Potatoes	None
„ ...	W. Kinsella, Crosstown, Wexford	Heavy Clay	Potatoes	None
„ ...	N. Mullett, Toberona, Enniscorthy	Shingly Clay	Potatoes	None
„ ...	J. Donohoe, Ballymotebeg, Enniscorthy.	Shingly Clay	Potatoes	None
„ ...	J. Barnewell, Kilmannock, Campile	Heavy Clay	Grass	4 cwt. Super., 1 cwt. Kainit, 1 cwt. Sulph. of Ammonia.
„ ...	S. Sunderland, Ballinastraw, Monamolin.	Heavy Clay	Stubble	6 cwt. Complete Mixt. per acre.
Wicklow ...	P. Carr, Ashtown, Wicklow ...	Heavy Loam	Potatoes	None
„ ...	P. Byrne, Cloneen, Aughrim ...	Medium Heavy Loam.	Potatoes	1 cwt. Sulph. of Ammonia in Spring.
„ ...	D. O'Riordan, Ballyguile, Wicklow	Shingly Loam	Potatoes	None
„ ...	J. Kavanagh, Kilballyowen, Aughrim.	Shingly Loam	Potatoes	None
„ ...	W. Hammond, Paulbeg, Shillelagh	Black Loam	Potatoes	None
„ ...	M. Kavanagh, Reddna, Aughrim	Medium Loam	Potatoes	None
„ ...	Rev. W. H. Johnston, Teglin, Newcastle.	Medium Loam	Oats	None
„ ...	J. Kavanagh, Ballinamanogue, Tinahely	Medium Loam	Potatoes	None

Average yield of grain per statute

1926–27—(*continued*).

Date of Sowing	Date of Harvesting	Yield per Statute Acre T.	C.	Q.	Percentage of moisture in Sample	Classification of Sample	OBSERVATIONS
24 Novr. 1926	8 Sept., 1927	—	12	2	22·70	B.	Crop grew thinly, land waterlogged in parts.
7 Dec., 1926	25 Aug., 1927	—	17	3	17·40	B.	
— Feb., 1927	3 Sept., 1927	1	5	2	20·10	B.	
15 Novr., 1926	3 Sept., 1927	1	1	1	19·45	A.	
13 Dec., 1926	18 Aug., 1927	1	10	3	18·51	A.	
13 Dec., 1926	13 Aug., 1927	1	12	—	18·54	B.	
3 Dec., 1926	13 Aug., 1927	1	8	3	18·10	B.	
13 Dec., 1926	24 Aug., 1927	1	5	2	20·65	A.	
13 Dec., 1926	18 Aug., 1927	1	2	2	18·88	B.	
16 Dec., 1926	30 Aug., 1927	1	2	—	18·74	A.	
9 Dec., 1926	18 Aug., 1927	1	6	3	18·68	B.	
13 Dec., 1926	17 Aug., 1927	1	2	3	17·70	B.	
18 Dec., 1926	——	—	—	—	—	—	Failure, defective germination.
21 Feb., 1927	——	—	—	—	—	—	Do.
24 Dec., 1926	——	—	—	—	—	—	Do.
21 Jan., 1927	——	—	—	—	—	—	Do.
30 Oct., 1926	13 Aug., 1927	1	—	3	19·55	A.	3-4 cwt. per acre lost, due to damage by crows after harvesting.
13 Novr., 1926	27 Aug., 1927	1	4	0½	19·06	B.	
14 Oct., 1926	22 Aug., 1927	1	6	3	18·41	C.	Damaged by birds after sowing.
16 Novr., 1926	5 Sept., 1927	1	14	1½	19·45	B.	
13 Oct., 1926	21 Aug., 1927	1	11	1	18·29	A.	
29 Novr., 1926	21 Aug., 1927	1	7	3½	17·75	B.	
13 Oct., 1926	23 Aug., 1927	1	9	2½	19·62	B.	
13 Oct., 1926	21 Aug., 1927	1	8	2½	22·54	C.	
12 Novr., 1926	23 Sept., 1927	1	10	—	18·61	A.	
20 Oct., 1926	29 Aug., 1927	1	18	1	18·93	B.	
20 Oct., 1926	3 Sept., 1927	1	8	3	17·43	A.	
5 Dec., 1926	——	—	—	—	—	—	Failure, due to late sowing and damage by crows.
8 Novr., 1926	——	—	—	—	—	—	Failure, due to heating before being sown.
8 Novr., 1926	——	—	—	—	—	—	Do.
20 Novr., 1926	20 Sept., 1927	1	8	3	17·17	A.	
16 Novr., 1926	End Sept. 1927	—	16	1	—	——	Partial failure, due to damage by cattle.
26 Oct., 1926	26 Aug., 1927	1	13	3	19·20	A.	
8 Novr., 1926	26 Aug., 1927	1	5	3	17·55	A.	
26 Oct., 1926	29 Aug., 1927	1	2	2	20·29	A.	
20 Oct., 1926	29 Aug., 1927	1	2	1	18·71	B.	
20 Novr., 1926	24 Aug., 1927	1	—	—	18·20	A.	
18 Oct., 1926	2 Sept., 1927	—	15	—	18·40	A.	Yield reduced, due to damage by rabbits, etc.
3 Novr., 1926	15 Aug., 1927	—	10	3	18·02	A.	Do.
4 Jan., 1927	——	—	—	—	—	—	Failure, due to unfavourable weather conditions.

acre (179 centres) 23 cwt. 3 qrs.

Obituary.

On 24th January last Captain Charles J. McCarthy, one of the Senior Inspectors of the Department, died suddenly at his residence as he was preparing to proceed to the office for his usual duties. The cause of death was heart failure, brought about, it was thought, through an attack of influenza which he had not regarded as serious. In fact early in the same month he attended the Annual Congress of the Irish Dairy Shorthorn Breeders' Society at Thurles whilst suffering from a severe cold, but he seemed to have regained his normal good health when death claimed him. It was typical of the man's whole official life that towards its close he should give little thought to his own health or comfort when his services were required in the interests of the farming community.

Captain McCarthy sprung from old farming stock in Mid-Cork. He was born within sight of the ruins of the famous abbey at Kilcrea, where his remains now fittingly rest, as this place had a great charm for him. Educated at local primary and secondary schools he engaged in farming at home for some years before taking out a course in higher agricultural education. In the year 1903 he competed for and was awarded a scholarship at the College of Science. This gave him what he had particularly wished for even during his school days, namely, an opportunity of making a scientific study of agricultural problems. He read a brilliant course and was regarded as the best agricultural student of his year. At the conclusion of his studies in 1906 he was immediately appointed as the first Instructor in Agriculture in Co. Kerry, and as a result of the capacity which he displayed and the remarkable success which attended his work he was promoted within two years to the post of Inspector in charge of the agricultural and live stock schemes in Munster.

Whilst occupying this post Captain McCarthy spent the greater part of his vacation each year in studying systems of agriculture in continental countries. In 1912 he decided to make an extended tour abroad for health reasons and also with a view to acquiring a first-hand knowledge of agricultural developments in other countries. He visited Australia, America and Canada, in which countries he had many friends, and in the course of his travels he sent home valuable reports which proved of moment to this country.

Returning some time before the outbreak of the European War he re-entered the service of the Department, but shortly afterwards accepted an offer of an important post in connection with the purchase of food supplies for the allied armies. At the close of the war he retired with the rank of captain and received a distinction from the King of the Belgians in recognition of exceptional services which he had rendered to the Belgian Army. On resuming duty with the Department he was placed in charge of the Agricultural School, Clonakilty, and was Principal of this institution until appointed live stock inspector early in 1925. From that date to the time of his death he took a large share in the administration of the various improvement schemes, including the application of the Live Stock Breeding Act to bulls. He devoted himself whole-heartedly to the improvement of cattle, swine, sheep, horses and goats, and was equally interested and expert in all classes of stock. His skill and judgment in this connection were recognised not alone by breed societies and breeders in this country, but also in Great Britain and abroad. For example, applications for his services as a judge were being constantly received from Great Britain and from places as far distant as Argentina.

Gifted with an extraordinary love of animals and an unerring eye for conformation, Captain McCarthy was one of those really great judges of stock few of whom are born in any generation. In addition to being a first class judge he had a sound conception of the place which improved live stock should occupy in the general agricultural economy. This is evidenced by the clear and able statement on live stock policy which he prepared for the Thurles Congress and which is printed elsewhere in this issue of the Journal. Not a little of Captain McCarthy's success in life was due to the confidence and regard which his gentle and straightforward manner inspired amongst all with whom he came in contact. The public tributes which have been paid to him since his death are remarkable, but are not more than he had earned by the loyal and efficient service which he so unselfishly gave to the farmers of this country.

O'Brien] [Fermoy

The late Capt. Charles J. McCarthy, A.R.C.Sc.I.
Taken whilst on duty shortly before his death.

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NOTES AND MEMORANDA.

Danish Butter Judgings, 1926.

The Danish State Experimental Laboratory, in the course of their report on official judgings of export butter in 1926, state that, out of a total of 1,593 creameries, about 10 per cent. of the co-operative creameries and 53 per cent. of those which are privately owned, were notified that their butter was poor in quality. In the course of the year, 14 creameries lost the right to use the Lur Brand, but of these 8 recovered that privilege before the close of the year. Of these creameries, one was co-operative, the rest were privately owned. The report states further that 94·5 per cent. of all the butter examined may be called *first-class* butter; 4·5 per cent. may be described as *inferior*, and 1 per cent. as *poor* butter.

The average moisture content in the 5,442 samples examined was 14·33 per cent. The following table gives the average moisture content for each year since 1909; it shows that the characteristic moisture content of Danish butter is about 14·35 per cent.

Year.	*% Moisture.*	*Year.*	*% Moisture.*
1909	14·23	1918	13·95
1910	14·14	1919	14·03
1911	14·15	1920	14·12
1912	14·21	1921	14·18
1913	14·17	1922	14·12
1914	14·13	1923	14·32
1915	14·08	1924	14·40
1916	14·12	1925	14·31
1917	14·02	1926	14·33

Anticipating Pig Prices.

In view of the growing importance of the pig industry, a report on "The forecasting of pig prices," by Dr. Arthur Hanau, published by the German Institution for Prices Research, is of special interest. The writer, who is, of course, dealing with German conditions—states that the movement of prices for bonhams should be studied in connection with an analysis of price movements on the pig market. It will, he says, be observed that the variations in bonham prices are relatively greater than are those of pig prices. It is therefore of the utmost importance that, not only the farmer who has young pigs for sale, but also the man who buys them for fattening, should have a better knowledge of the conditions on the bonham market. Bonham prices tend to rise seasonally in the early months of the year, and remain at a high level during the spring. From the month of June they fall steadily and reach their lowest level in October, where they remain until December.

On the other hand, the supply of bonhams reaches its highest in the period March-October, and its lowest in winter. The seasonal high level of prices in the spring coincides with a big demand in that season.

The seasonal movement of bonham prices thus moves in a contrary direction to that of pig prices. The idea current in farming circles that periods of better pig prices coincide with periods of low bonham prices, and periods of lower pig prices with periods of higher bonham prices—the "pig market balance," as it is called—is thus confirmed, but only as a seasonal phenomenon. It would be more correct to speak of a "seasonal balance" of the pig market.

If the seasonal fluctuations are excluded, a comparison between the movement of prices for bonhams and for pigs will reveal the fact that there are distinct correlations between the two markets which, if closely studied, will enable farmers to deduce the movement of bonham prices from an expected movement in pig prices.

This agreement between the pig market and the bonham market is, says Hanau, due to the following causes; so long as the movement of prices for fat pigs appears to offer an economic profit on fattening, a strong demand for bonhams for fattening will keep their price at a favourable level, even though supplies be increasing. But if prices for fat swine are such that the keeping of bonhams does not offer a prospect of profit, the demand for bonhams declines so far that even a falling off in the supplies of bonhams is powerless to bring about a recovery. The result of these conditions is that the production costs of pigs marketed during the first 12 months of a downward movement of prices have to bear exceptionally heavy charges in outlay for bonhams; while the production costs of pigs sold during the first 12 months of an upward movement of prices afford specially good prospects, thanks to small outlay for bonhams.

Agricultural Credits in New Zealand.

The Rural Intermediate Credit Act, which was passed by the New Zealand Parliament at the close of 1927, has for its principal object the provision of credit for farming operations over periods of less length than those usually covered by mortgage but for longer periods than those customarily granted by firms selling stock, implements, fertilizers and other necessaries. The Act is designed to assist settlers and workers in the purchase of farm lands and homes, and thus to further the development of agriculture and other industries.

Under the provisions of the earlier legislation, funds were advanced to settlers amounting to from £25 to £2,500 on approved security, each advance being repayable in half-yearly instalments equivalent to 3 per cent. of the

amount borrowed. The original Act and amendments were consolidated in the State Advances Act, 1913, which has since that time authorised the borrowing of funds for advances to settlers, workers and local authorities in annual amounts totalling £5,000,000, £1,500,000 and £5,000,000 respectively.

Under the most recent legislation, groups of farmers formed into associations or co-operative societies, and individual farmers, will have the right to participate in the funds which will be available to the Rural Intermediate Credit Board; a newly constituted body of which the Public Trustee is the principal executive member. Such amounts will be obtained by the issue of debentures, backed by the security of borrowers, and half the amounts advanced by the Government. These advances may not exceed £400,000. and 50 per cent. of any loans made to the Board by the Government must be invested in State securities for the purpose of meeting maturing debentures.

Authorisation is given to the formation of Rural Intermediate Credit Associations by twenty or more persons engaged in agricultural operations, the purpose of these bodies being to obtain funds from the Board for distribution to members of the Association; co-operative societies of not less than 30 members, and subscribed capital exceeding £2,500, may also borrow for similar objects, while individual farmers as well may secure loans directly from the Board itself. In the case of Rural Intermediate Credit Associations, it is stipulated that loans must be limited to £1,000 in the case of each borrower and to 10 per cent. of the nominal value of shares held in the Association, while the duration of the loan must be for not less than six months nor more than five years. Members of co-operative societies may borrow from funds secured by the society for periods of not less than six months nor more than three years, the amounts of loans being limited by the total available for the society, which may be up to 80 per cent. of the value of live stock or produce held, *plus* personal, collateral security if required. Loans to individual farmers are conditional on the provision of personal security and the guarantee of a second party and may not exceed 80 per cent. of the value of the goods purchased or the security offered, while the guarantors must stand good for 20 per cent. of any advance. The amount advanced to any individual may not exceed £1,000.

In addition to the authority to advance moneys in this manner, the Board is also empowered to discount promissory notes and bills of exchange as a supplementary means of supplying funds to the agricultural community. Regulations limiting the extent of such operations have yet to be issued, but it is not anticipated that the Board's activities will embrace anything but a small amount of discount business.

Black Scab in Potatoes; Some French Experiments.

Some experiments in connection with potato wart disease have been carried out in the French Province of Lower Rhine at a place called Russ-Hersbach. From inquiries into the sources of contamination, it appears that

infection may be carried : (1) by soil from a depth of 50 cm.; (2) by soil from a field which had carried an affected crop in 1926 and 1925; (3) by the sweepings of a cellar which, after having contained tubers affected with wart disease, had been treated with lime; (4) by rubbish from a village situated in the area of the outbreak; (5) by earth taken from a meadow which received drainage water from that locality, and (6) by soil carried on turnips pulled in a field which had been contaminated in the preceding year.

On the other hand, the experiments made for the purpose of ascertaining whether contamination might take place through the air, showed that in the conditions of the test (pots containing non-infected earth placed in the immediate vicinity of contaminated plants) this did not take place.

Amongst the products employed with the object of destroying the fungus in the soil, carbon disulphide, chloride of lime, permanganate of potash, and Javel water, *did not appear to have exercised any fungicide action to speak of*. Sulphur and sulphate of copper, on which certain hopes had been founded, were unable to protect the plants against the attack of the fungus, even when used in doses nearly sufficient to prevent growth.

Formol alone, at the rate of 1 to 1½ litres per square metre, in a 40 per cent. solution (1 litre and half of formol to 18·5 litres of water; 20 litres of liquid per square metre) was somewhat efficacious.

The safest course of all is to use varieties which have been found to be immune to the disease.

Poultry Flock Competitions in Denmark.

The 25th national competition between whole poultry flocks in Denmark covered the period from 1st November to 31st October, 1927; it was the largest yet organised. The number of competing flocks was 84, and of these, 45 obtained premiums. Winners of first-class premiums are recognised as approved breeding centres for one year.

The object of these competitions has been to place the poultry industry on a firm economic basis by the introduction of improved methods of feeding and breeding, and the systematic keeping of pedigrees and other records. The value of the competitions is fully appreciated by Danish poultry-keepers, and the number of competing flocks is larger every year.

The winning flock in 1927 consisted of brown Leghorns of excellent appearance. At the opening of the competition, there were 67 pullets and 51 hens. All the birds were trap-nested and all eggs were weighed. The chickens were large and strong, and 290 out of a total of 380 were marked. The entire plant was run on model lines. The well-equipped hen-house is divided into two large rooms for the young stock and four smaller ones for the breeders; there are also four rooms for chicks. There is a very large run, planted with trees, with good shelter, and the birds have also access to a large patch of enclosed woodland. Order and cleanliness prevail. Five incubators are in use. The accounts are well kept and illuminating. During the year of the competition, the following foodstuffs were consumed: 4,259 lb. of oats, 4,173 lb. wheat, 4,393 lb. maize, 132 lb. bran, 4,620 lb. "B.B.B." chicken food, 880 lb. shells, and 850 gallons of buttermilk,

besides greenstuff and roots, which are obtained in return for the fowl droppings. The breeding work is well done, and proper regard is had to the weight of the eggs. On both sides the breeding stock is of the best possible strain. During the years of the competition, 47 hens laid 9,938 eggs, or 211 eggs per hen, and one bird, which was of a very good strain, laid during the past three years, 272, 221 and 217 eggs, respectively, or 711 eggs altogether, of an average weight of 2·1 oz. During the year, 3,500 of the flock's own eggs were set for hatching, and of these, 77 per cent. produced chicks.

The average number of eggs laid by 103 hens during the year was 189, or a total of 19,470 eggs. The nett profits for the year amounted to about £79.

The Bulgarian Egg Industry.

In pre-war days, Bulgaria's egg export was considerable. In 1912, it amounted to 14,376 tons, but the Balkan war and then the Great War ruined the trade, which was not resumed until 1921, when 2,636 tons of eggs were exported. During the following years, the export slowly increased, and in 1927 had reached the figure of 12,443 tons. The reason why the export has not yet attained its previous dimensions is because the fertile province of Dobrudja, which used to form part of Bulgaria, is now a Rumanian possession. The loss of this territory reduced Bulgaria's egg export trade by 25 per cent. Even so, eggs still take the third place, after tobacco and corn, in Bulgaria's export list. Great interest is being taken in poultry rearing, and efforts are being made to improve the Bulgarian hen and also to introduce new breeds. Bulgarian eggs are in good demand on foreign markets and, as regards weight, they take a high place. Thus, the average weight recognised on the international market for the eggs of different countries is as follows: Danish 66·6 grammes, Dutch 64·6, Bulgarian 55·5, Russian 55·5, Yugo-Slavian 52·1, Rumanian 50·0, Egyptian 45·5 grammes, etc. The principal market for Bulgarian eggs has hitherto been Germany, 7 per cent. of whose imported eggs were obtained from Bulgaria. Switzerland and Austria are also good markets, but the last-named country takes chiefly second and third quality eggs.

Number of Pigs in France.

According to an official return, the number of pigs in France is steadily increasing; though it has not yet reached the pre-war figure. The numbers were as follows during the period 1923-27; the figures for 1913 are given for purposes of comparison:—

1927	...	...	6,019,450
1926	...	...	5,776,900
1925	...	...	5,792,860
1924	...	...	5,801,830
1923	...	...	5,405,840
1913	...	...	7,035,850

Danish Dairying Statistics, 1926-27.

The thirty-first annual report on Danish dairying statistics includes the returns for the year 1926-27. These returns were furnished by 826 creameries, or 15 fewer than in the previous year. The report deplores the fact that the aims and importance of these returns are not more generally appreciated by Danish creameries. This is shown by the fact that only 67 per cent. of all the co-operative creameries in the country sent in returns. The following are the principal averages which have been worked out from data supplied during the past two years. The figures have been converted into their approximate English equivalents:—

	1926–27	1925–26
Number of members per creamery	143	142
Number of cows per creamery	990	944
Milk yield per cow	644 galls.	639 galls.
Total milk handled per creamery	2964 tons	2798 tons
Actual working costs (exclusive of cheese-making) per 100 galls. milk	7s. 6¼d.	8s. 7½d.
Reduced working costs per 100 galls. milk ...	4s. 7d.	5s. 1½d.
Amount of milk per lb. butter	24·1 lb.	24·3 lb.
Price of butter per lb.	1s. 6d.	1s. 7½d.
Gross receipts from butter in 100 galls. of milk ...	£3 3s. 7d.	£3 7s. 6d.
Nett receipts per lb. of milk used for butter making ...	Rather less than 1d.	Rather less than 1d.

A slight decrease in working expenses had already been noted in 1925, and the following year showed a further fall of 10 per cent. In 1927, the average figure fell again by 13 per cent., but the average for the country as a whole is still 64 per cent. higher than it was in 1914. In some districts it is as high as 80 per cent., in others as low as 39 per cent. By way of comparison, it may be stated that the price of butter was 45 per cent. higher in 1927 than it was in 1914.

Swedish Sugar Industry, 1927.

During the year 1927, all the Swedish sugar factories, which now number 21, were in full work. All but three of these factories belong to the Swedish Sugar Manufacturing Co., Ltd., Malmö. Over 100,400 acres of beet were planted, and over 950,000 tons of beets were handled during the year. The average sugar content was 16·61 per cent., the highest record being 17·81 and the lowest 16·20 per cent. Beets must be loaded by growers direct into the railway wagons; should the latter not be obtainable, the Company are bound to provide storage place for beets still to be delivered or already on the way.

Since the spring of 1924 the Company have made soil surveys with a view to increasing beet growing. These have shown that the best crop was obtained on fields which had been limed to give a slight alkaline

reaction, *i.e.*, having a pH index between 7 and 7·4. Liming was also found to be beneficial against mildew, which generally occurs on sour land.

As a basis for price fixing is taken the average price per kilo of sugar paid by wholesalers to the Company from 1st February in the year when the crop was grown to 31st January of the year following, minus the sugar duty and the wholesale rebate, which now amounts to 4 per cent. of the gross price. The effective price thus calculated forms the basic figure for calculating the price of beets. For 100 kg. of sugar beet with 16 per cent. sugar, the price is 6·5 times the basic price described above. For every one-tenth per cent. increase or decrease in the average sugar content, the price of beets rises or falls by 1 Ore per 100 kg. For beets delivered by rail after 15th November the Company pays a supplementary price of 20 Ore per 100 kg., in compensation for extra costs of transport. This allowance is not made for beets which, according to the grower's contract, might have been delivered before 15th November, nor for beets damaged by frost at the time of loading into the wagon.

Export Subsidy for New Zealand Pork.

The New Zealand Government are taking active steps to encourage the production and export of pork products. The industry is said to have suffered in the past from lack of intelligent interest and scientific investigation, and efforts are now being made to regain lost ground. Numerous associations are being formed to promote pork production, the aid of live stock experts in the various agricultural colleges and the Department of Agriculture has been enlisted, and numerous experiments are being made to determine the most satisfactory breeds, systems of feeding and similar problems peculiar to local conditions. The Government, too, in accordance with their policy of supervising and assisting the marketing of farm produce, have offered a refund of one halfpenny per pound weight on all pork carcases exported to Great Britain. The refund is payable to all exporters of pork on oversea freight weights, is applicable to shipments of pigs killed from February 1 to October 31, and is limited to payments for carcases weighing from 60 to 180 pounds. Altogether, it is anticipated that an expenditure amounting to £30,000 a year may be involved, and it is understood that the Government have expressed their willingness to continue such payments during the seasons 1928-30. Refunds are payable through the Department of Agriculture on the receipt of completed declarations of the number and weight of pork carcases exported.

While it is recognised that such a subsidy cannot fail to stimulate the export trade, the fact that the pig industry has passed through a period of unsatisfactory market conditions has been an added reason for Government assistance. The brisk demand of United Kingdom importers of bacon and hams during 1926 was followed both by a market depression and by heavy receipts from Canada and the United States, and again by the liquidation of stocks containing boric acid, following regulations prohibiting its use as from 1st July, 1927. Nevertheless, the volume of exports to the United Kingdom during 1927 showed an increase over the previous year, despite

reductions in prices. Exports to Australia also were satisfactorily maintained, but it is feared by exporters that increased duties may prove a serious obstacle to the continuance of this branch of their business.

It is hoped that increased efficiency in production, resulting principally from the improvement of stock and the reduction of costs, together with a more highly developed marketing technique, will lead to the early establishment of New Zealand as one of the chief sources from which the United Kingdom market will draw its supplies of bacon, ham and other pork products.

World's Sugar Beet Crop, 1928.

According to a statement of the Bureau of Agricultural Economics of the United States Department of Agriculture, the total 1928 sugar beet acreage in Canada, United States and 20 European countries showed an increase of 3·8 per cent. over that of 1927. These countries accounted for 97 per cent of the world sugar beet acreage during the last three years. Scotland, Yugoslavia and Australia are the only countries, regularly reporting, from which 1928 estimates had not yet been received. Acreage in these countries in 1927 was reported at 13,000 acres, 106,000 acres and 3,000 acres respectively.

The total acreage devoted to sugar beets in Canada and the United States was slightly below that of the previous year, being placed at 743,000 acres as against 765,103 acres for 1927. The acreage in 20 European countries, including Russia, was placed at 6,182,000 acres, or 4·6 per cent. above the 5,907,569 acres reported for these countries in 1927. Excluding Russia, the 1928 sugar beet acreage was only 50,000 acres above last year. Among the chief sugar exporting countries in Europe, increased acreages were reported for Germany, Poland and Hungary; this, however, was partly offset by reduced averages in Czechoslovakia, Belgium and the Netherlands.

Australian Egg Export Regulations.

A proclamation, dated 22nd September, 1927, amended the regulations dealing with the export of eggs in shell and egg pulp from Australia. According to the amended regulations, the term " clean " in relation to eggs in shell, means free from stain, dirt, or other foreign matter, but does not include eggs that have been washed. " Fresh," in relation to egg pulp, means that the pulp is fit for human consumption and is considered by an officer to be fit for export. " Fresh " in relation to eggs in shell, means that the eggs, after examination by the candling process are, in the opinion of an officer, fit for human consumption and are not more than seven days old.

Eggs used for the preparation of egg pulp must be individually examined by the candling process under the supervision of an officer, besides being inspected during individual breaking. These eggs must be broken by hand into a cup of a type approved by the officer, who may reject all eggs which he considers unfit for pulping. No egg which is in an unsound or otherwise

abnormal condition may be used. The preparation of the eggs must be carried out under approved sanitary conditions, and egg pulp must be packed only in clean new containers of approved type.

Eggs in shell intended for export must be hen eggs; all others are discarded. The eggs must be examined by the candling process under supervision of an officer and at approved premises. Eggs which have been subjected to any preservative process, or which have been placed in cold store prior to being submitted for export, shall not be packed. No egg which has a broken or damaged shell, or is in an unsound or otherwise abnormal condition, shall be packed.

Eggs are packed in two sizes: (*a*) not less than $15\frac{1}{2}$ pounds net weight per each ten dozen eggs, provided that no egg shall weigh less than 2 ounces, and (*b*) not less than 14 pounds net weight per each ten dozen eggs, provided that no egg shall weigh less than $1\frac{3}{4}$ ounces.

The eggs in each box shall be fresh, clean, of uniform size and not misshapen. Any officer may reject any eggs considered by him to be unfit for export.

Under the new Regulations, eggs must be packed in new cases made of well seasoned softwood or hardwood that has been smoothly sawn or dressed in an approved manner, strapped with metal strapping or wire, and sufficiently strong, in the opinion of the Collector, to withstand such handling as is ordinarily incidental to transport beyond the Commonwealth. Each case shall contain 30 eggs, packed in separate divisions made of white odourless wood-pulp board. A pad of wood wool or other odourless substance approved by the Collector shall be placed at the bottom and top of each case, and not less than one pad in the centre layer of eggs.

The label or brand shall specify the net weight or quantity of the goods, provided that, in the case of eggs in shell, the net weight per long hundred as well as the total net weight of eggs contained in the box shall be specified. In the case of egg pulp, the trade description shall indicate whether the pulp consists of whole eggs or of the white or yolk of eggs.

New Danish Brand for Exported Meat.

The Danish Ministry of Agriculture issued an Order dated 8th August, 1928, amending their existing regulations for the exportation of meat to England, and coming into force on 19th September, 1928. The Order provides a brand which is to be applied to carcases of pigs of the First Class A which are exported direct from Danish abattoirs to Great Britain and Ireland. The brand is oval at the top and bottom, with straight ends; it contains the word "Danish" and the number of the abattoir, and it is to be applied to every half carcase, on shoulder, neck and ham.

POTATO WART DISEASE IN SWEDEN.

The first case of wart disease of potatoes reported in Sweden was discovered in August, 1928, at Allerums in the province of Malmö, in Southern Sweden. The disease was confined to a very small area of only some 25 square yards in extent. Unfortunately a second case was soon after reported, this time from a totally different part of the country, viz., Högsjö, in the province of Södermannsland, which lies S.W. of Stockholm. In this instance, a plot measuring some 400 sq. yards, belonging to a railway linesman, was found to be badly affected. Thus, notwithstanding the strict import regulations imposed by the Swedish Government, the pest has managed to find entry, and by different channels, for it is not supposed that these two outbreaks, remote from each other, had a common origin. One suggestion is that the Swedish Order prohibiting the importation of potatoes from infected countries came too late, and that the disease had already crossed the frontier, coming possibly from Germany, from which country Sweden imported large quantities of potatoes during the war period. The probability of this having been the source of another imported potato pest, the nematode, has already been mooted and, curiously enough, the two cases of Wart Disease now reported are in districts where the nematode has been found.

Persons in both the localities affected state that the disease had been observed at least a year ago; if this be so, the violence of the outbreak is not surprising.

A second suggestion is that the potatoes carrying the disease may have been smuggled into the country since 1921, the year when the prohibiting orders were issued. Though there is nothing in these two first outbreaks to suggest anything of the kind, the possibility must none the less be considered.

Measures to control the disease were immediately adopted by the Swedish authorities, and the Government placed a sum of 5,000 crowns (£286) at their disposal for the purpose. An application for three times that amount has since been made by the department entrusted with the task of combating the outbreak.

FOREIGN EGGS TO BE MARKED IN PARIS.

The head of the Paris police states that large quantities of foreign eggs come to Paris, especially in autumn and winter, which have hitherto been sold by retailers without any special mention of their origin. As these eggs are constantly sold, wholesale, at a price slightly lower than that of French eggs of the same size and quality, they might possibly give rise to abuse and to fraud. The police therefore, acting in concert with the Ministry of Agriculture, have issued an order to both wholesalers and retailers, requiring them to mark all imported eggs: "Foreign eggs" or "Eggs imported from...........".

Increased Exportation of Pigs from Holland.

The export trade in pigs from Holland showed a remarkable increase in 1927. The principal buying countries were France, Germany, Belgium and Italy. The number of pigs exported to these countries during the years 1927 and 1926 was as follows:—

	1927.	1926.
France	44,791	86
Italy	19,991	—
Germany	10,759	1,152
Belgium	10,092	3,577

Notwithstanding the fact that England took no fresh pork from Holland in 1927, the total export from the latter country was considerably larger than it had been in 1926, thanks to the fact that France was a much bigger buyer than she had been heretofore. Out of a total export of 51 million kilos of pork in 1927, as against 28½ million kilos in 1926, France accounted for no less than 21½ million kilos, whilst Germany took 9 million kilos. Holland's export of salt pork also increased in 1927, when it totalled 50 million kilos. Of this, England took 43½ million kilos.

Electric Light in the Hen-Run.

Some experiments have been carried out at a Swiss electric supply works to test the effect of electric light in the hen-run during the darker months. The light was switched on automatically in the scratching run from 4 to 9 a.m. and from 4.30 to 6 p.m. In the previous winter, when no light was used, 41 hens laid 132 eggs during December and January; in the same period of the following year, when the light was turned on at the hours mentioned, the number of eggs produced was 730, whilst the number of hens was now only 29.

Butter Trade Organisation in Different Countries.

The butter trade throughout the world is daily becoming more highly organised, and official systems of inspection and grading are being more widely adopted. The Danish butter trade journal, "Smörtidende," has published a short account of what has already been accomplished in this direction and of what is projected in different countries. While the general rule is to combine a system of inspection and grading with the use of a national brand, Denmark alone has no butter-grading system. All her export butter is assumed to be of first-class quality, and this is guaranteed by the compulsory butter-tests at the Government Laboratory, in which all creameries must participate if they desire to export butter. If butter is found unworthy to bear the national Lur Brand, the creamery in question may not export its product.

Sweden has her Rune Brand, which is safeguarded in the same way as is

the Danish Lur Brand. The lower-grade butter is retained for sale on the home market, but licences are occasionally issued for the export of such butter to certain countries, notably Norway.

In Finland, export butter carries the mark of origin "Suomi," and all Finnish butter is subject to official classification since January, 1928. The bulk of Finnish butter is exported by the "Valio" co-operative society, and this organisation provides packages with its own guarantee.

In Norway a movement is on foot to establish a national butter brand. This will probably serve in the first instance as a guarantee on the home market, since Norway's export butter trade is very small indeed.

Estonia has had a butter inspection service since 1921, and the system has been tightened up from time to time. Butter is classed in three grades; only first and second-class butter may be exported; third-class butter must be sold locally.

Latvia, too, has a strict butter control system. Butter is divided into three classes, and only butter of the first two grades may be exported.

In Lithuania a recent Order has provided for the classifying of butter in several grades. All grades may be exported, but whilst the three highest grades may be exported free, butter of lower qualities is subject to an export duty.

Poland is about to introduce compulsory inspection of butter intended for export. Judges will be appointed by the Ministry of Agriculture, and premiums and medals will be awarded to creameries.

Russia (Siberia), too, has been considering a butter-grading system, and the Government intend to develop it. Creameries will receive direct intimation of the results of judgings, and third-class butter may not be exported. The Ukraine, which is persistently working to develop a large dairy industry, is also about to organise a butter-control system.

The overseas British Dominions, Australia and New Zealand, have, of course, long since established a strict system of butter inspection and grading, under which produce is judged by official experts, not only at the ports of shipment, but also on arrival at English ports. Australia's national brand is the Kangaroo; New Zealand's the Fernleaf.

Potato Wart Disease Order in Belgium.

Under Art. 1 of an Order dated 28th March, 1928, the Belgian Government authorises the importation of potatoes into that country only when consignments are accompanied by a certificate issued by the phytopathological service of the country of origin, attesting the fact that the tubers come from a district which is free from potato wart disease, that is, that they have been grown in and sent from a place situated at least 20 kilometres (12½ miles) from any land infected with wart disease. Nevertheless, potatoes grown in and forwarded from a place situated in a district not exempt from wart disease, but situated more than 500 metres (547 yards) from all infected land, may be imported, provided they are accom-

panied by certificates showing, to the satisfaction of the Department of Agriculture, that the consignments in question have been examined by the phytopathological service and found to be free from wart disease.

Art. 2 provides that consignments of potatoes sent by sea may be imported into Belgium through the customs offices at Antwerp, Bruges, Brussels, Ghent, Liège, Lille and Ostende. When imported over the land frontier they must enter by way of a customs office situated on a railway line, or else through one of a number of offices specially designated.

Under Act. 3 consignments not accompanied by the certificates required under Art. 1 will be refused, unless an examination of them by the special plant diseases service of Belgium, an examination made at the expense of the importers, shows that the consignments in question are free from wart disease.

Art. 4 provides for certain penalties for violations of the Order.

Canadian Permits for Imported Nursery Stock.

New regulations have been issued in Canada concerning the admission of nursery stock (trees, shrubs, vines, plants, bulbs, roots, etc.) sent by parcel post. Such parcels are only admitted provided a permit has been secured from the Secretary of the Destructive Insect and Pest Board, Ottawa, and parcels are addressed to the consignee, care of the Inspector of Plant Products at any one of the following posts: Halifax, N.S.; St. John, N.B.; Montreal, Ottawa (for scientific purposes only); Niagara Falls, Ont.; Winnipeg, Estevan, Sask.; and Vancouver B.C.

The importer in Canada must secure a permit to cover such shipments and will be provided with a special label, which he will forward to the shipper, who will affix the same to the package. After examination, the package will be forwarded to the destination in bond. Permits must be handed by the importer to the Collector of Customs at the point where duty is paid before the shipment can be cleared.

The importation of potatoes from California is prohibited, and potatoes from the States of Pennsylvania, West Virginia and Maryland must be accompanied by certificates of inspection certifying freedom from the potato wart disease.

Alleged Poisonous American Barley.

For some months past disquieting reports have been received from Germany, and also from Holland, as to the appearance of certain symptoms of poisoning in swine which had been fed with American Barley. The barley in question had been shipped from the ports of New York, Boston and Baltimore, but from the evidence of the weed-seeds contained in samples the grain appeared to have come from different parts of the country. It had no abnormal smell or appearance, though a good many grains had dark coloured tips. Some pigs refused it altogether, even when hungry; others ate it and became ill. The symptoms were vomiting, restlessness

and colic. The animals recovered, however, rapidly, and no deaths have been recorded. No definite signs of poison were noted in the organs of pigs killed for investigation purposes. Attempts to render the barley more acceptable by soaking, steaming and boiling were fruitless. A chemical examination of the barley failed to reveal the presence of metallic poisons: arsenic lead, quicksilver or copper. Microscopic examination, on the other hand, showed that the grain was infested with fungi and bacteria. The bacterial count of two cultures of American barley was respectively 12 times and 21 times that of home-grown German barley. Saprophytic germs were present in considerably greater numbers than in home-grown barley, and the relatively large number of vegetative bacteria showed that the grain had not received any treatment with a bactericidal preparation. To sum up, the results of the investigation show that, although the causes of the poisonous effects of using the barley in question could not be directly determined by bacteriological examination, the barley, by reason of its biological character, is open to suspicion in several respects. Its high content of actinomycetes and butyric acid bacteria is particularly striking.

In consequence of the actual happenings described above, the German Government issued a decree which came into force on 1st October, 1928, under which barley originating in the United States (except in Texas, Kansas, Oklahoma and Colorado) might only be imported when it was proved by examination (at the cost of the importer) to be not injurious for feeding purposes. The decree in question remained in force until the 15th November, after which it was further extended to the close of the year.

Colorado Beetle in France: Extent of Area Affected.

At a meeting of the French Society of Agriculturists, held in May, 1928, it was stated that the Colorado Beetle invasion had extended that year to the following French Departments: Gironde, Dordogne, Haute-Vienne, Charente, Corrèze and Deux-Sèvres. In the contaminated zone, control measures are being applied. The methods followed are: collection of the beetles, destruction by fire, spraying with lead arsenate, and injections of sulphate of carbon into the soil. These measures are found to be very effective in checking fresh centres. Unfortunately it has been found that farmers cannot be relied upon to declare the presence of the pest, and to apply the necessary treatments, and this notwithstanding the fact that declaration has been made compulsory by law. A strict watch is kept in what is called the protection zone, but additional funds are needed for this part of the work.

Beekeeping in Saorstat Eireann, 1928.

According to reports, furnished by the Itinerant Instructors in Horticulture, the beekeeping industry in Saorstat Eireann has been, on the whole, successful during the year 1928. There were some outbreaks of

disease among the bees, but not of a serious nature, and the number of hives increased throughout the country, in some cases by as much as 100 per cent.

Except in Counties Cavan and Wexford there has been increased swarming. However, the supplies of honey are less than in the preceding year, increased yields only being reported from two or three districts. The bees worked chiefly on clover, fruit and hawthorn.

As a rule the quantity of section honey available was disposed of locally; in Counties Kilkenny and Leix there were considerable quantities available for sale, but in East Limerick the supply in no way equalled the demand. There was practically no "run" honey available. A suggestion has been made that the marketing of honey in Co. Kilkenny should be done through the agency of the two local Beekeeping Associations. The prices obtained for honey varied from 8d. to 1/6 per section wholesale, and from 1/- to 2/- retail.

Scottish Bacon Pig Competition, 1929.

The Scottish Association of Pig Breeders announce that the Highland and Agricultural Society have again granted financial support and facilities to enable the Association to hold a Bacon Pig Competition at their Show in Alloa in July next. The competition is designed to secure consistency of placings of the exhibits: (a) as on hoof, (b) as carcases, and (c) as cured bacon, thus affording an opportunity for deducing from an examination of the carcases and cured bacon what points in the live pig should be regarded as most truly indicative of suitability for bacon purposes. The stages in each of which judging will take place are: I. The Live Pig. II. Carcases. III. Rolled Scottish Bacon. IV. Economic points. Pure bred and first cross pigs are eligible for entry, each entry to consist of two pigs which must be not more than 32 weeks old, and should be between 180 and 220 lb. live weight. Otherwise marks will be deducted. All exhibits must be suitable for bacon purposes. Money prizes and the Association's silver cup will be awarded.

Production of Peat Fuel in Canada.

The Quebec Department of Mines have surveyed, mapped and sampled over 250,000 acres of peat bogs in the provinces of Quebec and Ontario. The total content of standard peat fuel which can be manufactured from the peat in this area is estimated to be over 250 million tons, and the Dominion Fuel Board have recommended the use of peat where it can be produced and supplied economically as a means of reducing dependence upon imported anthracite.

The Dominion Government completed in 1928 a peat manufacturing plant at Alfred, Ontario, which, when in normal operation, will have a capacity of 20,000 tons of standard peat fuel, during a session of 100 days, operating 22 hours a day. Efforts will be made to market the fuel in an area within a 60-mile radius of the factory. A large portion of the output

is expected to be consumed locally, but the cities of Montreal and Quebec are also likely to prove good markets.

During the present summer (1929) a second plant, now in course of erection at St. Hyacinthe, Quebec, is expected to begin work. The product is the same as that manufactured at Alfred, but the method employed (the hydro-peat process) is radically different. At Alfred the peat is raised by an automatic excavator, macerated, spread on the ground, and cut into blocks for drying, but at St. Hyacinthe the peat will be excavated by powerful hydraulic jets. The resultant mixture of peat and water is distributed by pipe lines into shallow basins, where it is dried by the sun until it holds together, after which it is cut into blocks. The capacity of this plant when in full operation will be about 15,000 tons per annum. In Canada, peat is regarded as a valuable auxiliary fuel for heating in the early spring and late autumn, and is especially adapted for open fireplaces and kitchen ranges. It is not equal to anthracite in heating value, and is therefore not suitable for burning in furnaces during severe weather. It is estimated that about 20 per cent. of the domestic fuel requirements of the provinces of Quebec and Ontario could be met by peat.

QUARTERLY AVERAGE PRICES FOR EACH PROVINCE, AND FOR IRELAND, OF CROPS, LIVE STOCK, MEAT, PROVISIONS, &c., for the Quarter ended 31st December, 1928.

Produce.	Leinster			Munster			Ulster			Connaught			Ireland		
Crops—	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Wheat ... ... per 112 lb.	0	9	7	0	9	5	[illegible]	[illegible]	[illegible]		—		0	9	[illegible]
Oats (White) ... ,,	0	8	4	0	7	4	[illegible]	[illegible]	[illegible]	0	7	4	0	7	9
,, (Black) ... ,,	0	7	5	0	[illegible]	11	0	6	11		—		0	7	2
Barley ... ... ,,	0	8	0	0	7	5		—			—		0	7	11
Potatoes ... ... ,,	0	5	3	0	6	1	0	[illegible]	[illegible]	0	4	2	0	4	0
Hay (1st & 2nd Years' Crop), ton	5	3	3	4	5	6	4	5	6	2	17	9	4	11	6
,, (Meadow) ..	3	16	0	2	13	6	3	9	0	2	18	6	3	10	6
Grass Seed—															
Perennial per 112 lb.		—			—		0	13	6		—		0	13	0
Italian ,,		—			—		0	18	8		—		0	18	8
Flax ... ... per 14 lb.		—			—		0	11	4		—		0	11	4
Live Stock— per head															
Calves, under 6 months	3	6	3	2	15	6	2	9	3	3	7	3	3	0	6
Store Cattle—															
6 to 12 months ,,	7	9	3	6	2	0	6	19	9	7	19	9	6	18	9
1 to 2 years ... ,,	11	11	3	10	10	6	10	13	3	11	15	3	11	0	0
2 to 3 years ... ,,	15	8	9	14	1	3	14	0	3	15	8	6	14	15	3
3 years and over ,,	17	16	6	16	5	9	15	4	9	18	1	3	17	7	0
Fat Cattle—															
Under 2 years ,,	18	1	9	13	13	9(b)		—			—		13	19	9
2 to 3 years ... ,,	18	13	6	17	5	6	16	8	9	16	15	6	17	9	3
3 years and over ,,	21	1	0	18	13	0	17	19	6	20	13	0	20	4	6
Cows and Bulls ,,	15	4	6	12	16	9	14	10	3	17	7	6	13	9	0
Springers (Cows and Heifers) ,,	21	7	9	18	5	6	21	3	9	19	16	6	20	10	9
Milch Cows (down Calved) ,,	19	7	6	17	13	0	18	17	9	17	15	6	18	17	0
Lambs, under 12 months ,,	2	0	6	2	6	0	1	16	3	2	0	9	2	1	6
Store Sheep—															
1 to 2 years ... ,,	2	16	0	2	10	3	2	7	6	3	0	3	2	15	6
2 years and over ,,	2	2	9	1	6	3(c)	2	2	6	3	11	9	2	13	0
Fat Sheep—															
1 to 2 years ... ,,	3	0	6	3	7	9	2	8	9	3	15	9	3	4	9
2 years and over ,,	3	1	9	2	19	9	2	8	3	3	16	9	3	2	3
Young Pigs, under 12 weeks ,,	1	1	0	1	1	9	1	10	3	1	12	6	1	7	0
Store Pigs—															
12 weeks to 4 months ,,	1	15	0	1	9	6	1	15	0		—		1	12	9
4 months and over ,,	2	4	0	2	7	0		—			—		2	6	3
Fat Pigs (other than Sows) ,,	4	8	6	4	15	3	4	8	3		—		4	9	9
Fat Sows ... ... ,,		—			—			—			—			—	
Sows for Breeding ,,		—			—		6	7	3		—		6	7	3
Meat, Provisions, &c.—		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
(a) Beef (Live) ... per 112 lb.		41	3		—			—			—			—	
,, (Dead) ... ,,		72	3		—			—			—			—	
(a) Mutton (Live) ,,		50	3		—			—			—			—	
,, (Dead) ... ,,		88	0		—			—			—			—	
Pork (Dead) ... ,,		72	0		67	0		68	0		65	0		67	6
Eggs ... ... per 120		20	5		21	4		21	11		19	5		21	1
Wool ... ... per lb.		1	$2\frac{1}{2}$		—			0	10		—			1	$2\frac{3}{8}$

(a) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(b) Second class. (c) Chiefly Mountain Type.

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JOURNAL

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CONTENTS.

GRASS SILAGE

By Professor J. P. Drew, M.Sc., A.R.C.Sc.I., University College, Dublin;
G. F. O'Sullivan, M.Sc., and D. Deasy, B.Agr.Sc.

The conservation of grass as silage is by no means a new process, for records show that in the early days of silage-making meadow grass was frequently included amongst the various crops ensiled. The practice, however, has almost entirely disappeared owing to the poor quality of the material produced. In fact a large amount of the so-called silage formerly made had become so far decomposed by the time it was required for use that it was more or less valueless as fodder, and could only be regarded as little better than manure.

Considerable attention, however, is now being devoted to all the various aspects of the improvement of pastures, and as a result the output of our grass land is appreciably increased. Improvements in pastures are brought about principally by the use of more prolific strains of grasses, by more liberal manuring and by better management. With regard to the last it has been very clearly demonstrated by Woodman (1) that the nutritive value of young grass is vastly superior to the fodder produced from the same plants in a more mature state. He has shown for instance that the dry matter contained in young grass compares favourably with that in linseed cake, as is indicated in the following table taken from his paper:—

TABLE I.

——		Pasture Grass Spring, 1925.	Medium Meadow Hay.	Linseed Cake.	Undec. Cotton Cake.
Percentage digestibility		83·6	51·8	80·1	58·0
In 100 lbs. of Dry Matter	lb. dig. Protein ...	22·5	5·4	28·1	18·8
	lb. dig. Organic Matter ...	75·6	48·5	75·5	54·5
	lb. dig. Starch Equivalent	73·7	27·7	83·3	52·3

Woodman concludes (1) from his investigations that young pasture grass possesses a much higher feeding value than that usually assigned to it. Analysis of its dry matter shows it to be very rich in protein and of high digestibility. Its high nutritive value may by careful management, where the rainfall is sufficient, be maintained throughout the entire grazing season. It has also been shown that this food supplies the animal's requirements for vitamins and for lime and phosphate in sufficient quantity for bone formation and milk production. From the foregoing it will be seen that young pasture grass should be our cheapest, and possibly could be one of the best concentrated foods within easy reach of every farmer.

It would appear from Woodman's and other investigations that considerable advantage would accrue to the farming community if surplus grass produced during the height of the growing season could be stored, at an early stage of its growth, for winter consumption. Its conversion into hay is not a practical proposition as, apart from the difficulty in getting young grass sufficiently dry in our climate to prevent moulds developing in it during storage, there is a further difficulty in handling short grass, when partially dry, with the ordinary tools and implements in use during the process of making and storing hay.

From the experience that one of the writers (2) recently had in the making of meadow silage on more modern lines in a tower silo, the ensiling of grass in a more immature state than that at which it is usually made into hay was thought worthy of consideration and accordingly experiments were designed and carried out over a period of two years, 1927 and 1928.

FIRST YEAR EXPERIMENTS.

Silage.—An old permanent pasture of average quality was selected for an experiment. The field was previously grazed with cattle during the winter and spring. About the middle of April it was divided into two parts, one being intended for meadow hay and the other for grass silage. It was so late in the season when it was decided to carry out the experiment that it was not considered feasible to apply any manure at that stage.

The first cutting of grass for ensiling was made during the second week in June or about a month earlier than it would normally be cut for hay. The cutting was done with a mowing machine adjusted to cut as close to the ground as possible. The grass was then gathered into rows by a side delivery rake, after which it was carted to the stack-yard where it was passed through a chaff cutter and blown into a concrete tower silo.

It was as far as possible arranged that as the grass was cut it was placed in the silo on the same day. From previous experience in the making of meadow silage (2) this was considered essential particularly in dry weather. It was found also that a better collection of the grass was obtained with the side delivery rake when it was used as soon as possible after the grass was cut and before any drying took place. The American wheel rake was afterwards used for "clean raking."

The filling and packing of the silo was carried out in the ordinary way in which vetches and oats are ensiled (3). The difficulty previously experienced and recorded regarding the packing of more mature grasses even when chaffed (2) did not here present itself. When all the first cutting was stored in the silo it was covered with about six inches of clay to compress it and to exclude air as far as possible.

After the removal of the grass the aftermath was topdressed with nitrate of soda at the rate of 1 cwt. per statute acre. The weather during the second half of June was showery but unseasonably cold and not particularly

good for growth. More favourable growing conditions, however, obtained during July and August. A second cutting was made during the third week in August. The cutting and handling were carried out as already described. Before the grass was put into the silo, however, the layer of clay was removed as well as any of the underlying material which had become damaged during storage. The weather being showery the grass going into the silo was for the most part wet. When the filling was completed the clay was replaced.

Meadow Hay.—The plot reserved for hay was mown about mid-July and although the weather at that time was somewhat showery for haymaking, the crop was saved in good condition. About three weeks afterwards it was carted and stored in a hay barn. No manure was applied to this plot.

Yields.

The grass for ensiling was weighed as it was carried to the silo and the following were the results:—

	Tons	Cwts.	
1st cutting ...	2	15	per acre.
2nd cutting ...	5	10	,, ,,
	8	5	,, ,,

Owing to the field being grazed late in the season, to no artificial manure being applied, and to the unfavourable conditions for growth the yield at the first cutting was very low. The yield for the second cutting includes a certain amount of rain water—the grass, as already mentioned, having been cut and carted in showery weather.

The yield of mature silage compared with the yield of hay is as follows:—

Silage.	Hay.
5 tons 11 cwt. per acre.	1 ton 17 cwt. per acre.

SECOND YEAR EXPERIMENTS.

Owing to the encouraging results of the investigations on the making and feeding of grass silage obtained during 1927, it was decided to continue the work during 1928 when it was hoped that, by suitable manurial treatment, it would be possible to obtain three cuttings during the season and to increase the total output over that obtained in the previous year.

The field selected for the second year experiments was twelve statute acres in extent. It had been laid down to grass in good heart in 1917 and, in the meantime, had developed into a fairly good permanent pasture, white clover forming a high percentage of its herbage. It was grazed with store cattle till the 1st January.

An application of phosphates and potash was given to the whole experimental area in February, the mixture consisting of 4 cwts. superphosphate

and 3 cwt. kainit per statute acre. The field was afterwards divided into two parts, one for grass silage and the other for meadow hay. The silage plot afterwards received an application of sulphate of ammonia at the rate of 1 cwt. per acre in the last week in February. The meadow hay plot was also treated with sulphate of ammonia at the usual time for meadow hay, viz., the third week in March. Two dressings of nitrate of soda were subsequently given to the grass silage plot, one after the first cutting and the other after the second, the rate of application being 1 cwt. per acre in each case.

Grass Silage.—In order to facilitate close cutting the field was heavily rolled in March to level off the effects of the trampling by the cattle that had grazed it during the winter.

The first cutting of grass was carried out during the end of May and beginning of June, cocksfoot being in flower and perennial rye grass commencing to shoot. An earlier cutting would have been made but for the fact that the weather in May was dry and harsh and the bottom grasses were slow in developing. The cutting, handling and filling operations were carried out as in the 1927 experiments, the weather being dry and sunny.

During the greater part of June the weather was showery and unseasonably cold—conditions not suitable for maximum growth. Weather conditions in July were, however, more favourable and it was possible to get a second cutting towards the end of the month.

During August and the first part of September there was good growth for the time of the year, but the latter part of September was cold, with occasional ground frost at night. A third cutting was possible during the first week in October and though the yield was low no great difficulty was experienced in collecting the produce with the machinery already described. The produce of the third cutting contained no plants that had reached the stage of commencing to shoot, but the second cut contained a very small percentage of such plants.

The produce of each cutting was weighed as it was carted to the silo and the yields as well as the dates of cutting are set out in the following table:—

TABLE II.

——	Date of Cutting.	Yield per Statute Acre.		
		tons.	cwt.	qrs.
1st Cutting	29/5/'28 to 2/6/'28 ...	7	6	2
2nd Cutting	26/7/'28 to 27/7/'28 ...	3	3	3
3rd Cutting	1/10/'28 to 3/10/'28 ...	2	3	0
	Total ...	12	13	1

It is hardly necessary to draw attention to the fact that the high yield from the first cut in 1928 as compared with that of 1927 was due to (*a*) the application of suitable artificial manures in good time, (*b*) the field not having been grazed late in the season.

The total loss in weight during the process of ensiling was recorded and the quantity of silage produced per acre determined. The latter was as follows:—

YIELD OF SILAGE.—10 tons 5 cwts. per statute acre.

Meadow Hay.—The plot reserved for meadow was ready for mowing during the third week in June; but the weather conditions at the time were most unfavourable for haymaking, consequently the cutting had to be deferred until the second week in July when, with more favourable weather, hay of good quality was produced. Greater difficulty was experienced in cutting the long grass for hay than the shorter grass for silage.

The hay was weighed as it was carted to the stack-yard about three weeks after cutting with the following results:—

YIELD OF HAY.—3 tons 11 cwts. per statute acre.

CHEMICAL ANALYSIS OF THE GRASS, SILAGE, AND HAY.

During the process of ensiling a green crop the principal changes that occur are:—

(*a*) The conversion of some of the carbohydrate content (sugars and starches) into carbon dioxide and water, brought about by the respiration of the plant cells which continues for a time after the material has been filled into the silo.

(*b*) The breaking down of protein matter into less complex nitrogenous substances ("amino acids") through the activity of certain plant enzymes.

(*c*) The formation of organic acids (e.g. acetic acid, butyric acid, lactic acid) partly through the incomplete oxidation of carbohydrates in (*a*), and partly through the action of bacteria on carbohydrate matter. (4, 5, 6).

As a result of (*a*) and (*c*) it will be realised that, during ensiling, there must be a loss of carbohydrates. The "amino acids," which contain nitrogen and are really digestion products of proteins are not lost unless through drainage. These substances are soluble in water and are therefore present, together with soluble mineral matter, in any drainage that flows from the silo. The more succulent or the wetter the crop ensiled, the greater the drainage and, consequently, the greater the loss of nitrogenous and mineral matter. (5, 7, 8). It has been found also that the fibre undergoes slight loss due to bacterial activity, (5) and there is evidence that the fibre in silage is more digestible than the fibre of the green crop from which it was made (6). As some of the organic acids produced during ensiling are soluble in ether, the process of ensiling always entails an increase in the "oil" (ether extract of the ensilage).

The net result of these changes is a loss in dry matter, the extent of that loss depending on the nature of the crop, its condition at the time of filling, and the method of packing in the silo.

The following table shows the yield of dry matter per acre of the grass cuttings and the silage produced from each, together with the percentage loss due to ensiling, in the experiments of the first year.

TABLE III.

	Grass.			Silage.			
	Yield per Acre. cwt.	Percentage Dry Matter.	Yield of Dry Matter per Acre. cwt.	Yield per Acre. cwt.	Percentage Dry Matter.	Yield of Dry Matter per Acre. cwt.	Percentage Loss in Dry Matter.
1st Cutting ...	55	22·5	12·37	36·92	26·74	9·87	20·18
2nd Cutting ...	110	14·83	16·31	74·23	18·50	13·73	15·81

From Table III. it will be observed that the second cutting of grass contained only 14.83 per cent. of dry matter, the material at the time of filling being extremely wet from rain. Under these circumstances, as has been pointed out above, the loss by drainage is considerable. The first cutting, which was in the lower half of the silo, incurred a greater loss in dry matter than the second, being subjected to heavy pressure in addition to the leaching action of the drainage from the wet crop above.

The great difference in yield of grass in the first and second cuttings has already been explained in an earlier portion of the paper.

Table IV. gives particulars similar to those of Table III. for the experiments of the second year.

TABLE IV.

	Grass.			Silage.			
	Yield per Acre. cwt.	Percentage Dry Matter.	Yield of Dry Matter per Acre. cwt.	Yield per Acre. cwt.	Percentage Dry Matter.	Yield of Dry Matter per Acre. cwt.	Percentage Loss in Dry Matter.
1st Cutting ...	146·50	23·72	34·75	109·00	26·32	28·69	17·44
2nd Cutting ...	63·75	24·03	15·32	56·00	24·99	14·00	8·67
3rd Cutting ...	43·00	23·69	10·19	40·00	24·15	9·66	5·20

The three cuttings of grass in the second year were all cut and filled into the silo during fine weather, so that there was no adhering moisture, and the loss in dry matter was less than that in the first year. Again, however, this loss varied according to the position of the material in the silo, being greatest, as will be seen from the Table, in the first cutting which was under the pressure of, and received the drainage from the second and third cuttings, and least in the third which was on the top.

The difference between the yield of grass per acre in the first cutting of this year and that of the first cutting of the previous year has been accounted for in an earlier section.

Tables V. and VI. show the general analysis and the dry matter analysis respectively, of the grass, silage, and hay of the first year.

TABLE V.

	1st Cutting.		2nd Cutting.		Meadow Hay.
	Grass.	Silage.	Grass.	Silage.	
	%	%	%	%	%
Dry Matter	22·5	26·74	14·83	18·50	82·45
Moisture	77·5	73·26	85·17	81·50	17·55
Oil*	0·89	1·15	0·79	1·01	2·96
Protein	2·95	3·33	1·88	2·06	7·58
Fibre	5·05	7·40	3·58	6·08	21·74
Ash	1·54	2·14	1·46	1·84	5·49
Carbohydrates ...	12·07	12·72	7·12	7·51	44·68

* Extracted with Methylated Ether.

TABLE VI.

	1st Cutting.		2nd Cutting.		Meadow Hay.
	Grass.	Silage.	Grass.	Silage.	
Dry Matter	22·50	26·74	14·83	18·50	82·45
Oil*	3·94	4·29	5·33	5·47	3·59
Protein	13·12	12·47	12·69	11·15	9·19
Fibre	22·45	27·68	24·16	30·28	26·36
Ash	6·86	8·00	9·85	9·93	6·66
Carbohydrates ...	53·63	47·56	47·97	43·17	54·20

* Extracted with Methylated Ether.

The dry matter of the silage produced from both cuttings was richer in protein and mineral matter, but contained a somewhat higher percentage of fibre than that of the hay.

The Tables following (VII. and VIII.) show the particulars of the grass, silage and hay in the second year.

TABLE VII.

	1st Cutting.		2nd Cutting.		3rd Cutting.		Meadow Hay.
	Grass.	Silage.	Grass.	Silage.	Grass.	Silage.	
Dry Matter ...	23·72	26·32	24·03	24·99	23·69	24·15	82·54
Moisture ...	76·28	73·68	75·97	75·01	76·31	75·85	17·46
Oil*	0·47	0·86	0·55	0·81	0·54	1·14	1·12
Protein	2·54	2·53	2·88	2·81	3·42	3·59	5·36
Fibre	6·00	7·97	6·15	6·89	5·46	5·72	25·40
Ash	1·94	2·00	2·45	2·52	2·66	2·41	5·93
Carbohydrates ...	12·77	12·96	12·00	11·96	11·61	11·29	44·73

* Extracted with Petroleum Ether B.P. 40-60°C.

TABLE VIII.

	1st Cutting.		2nd Cutting.		3rd Cutting.		Meadow Hay.
	Grass.	Silage.	Grass.	Silage.	Grass.	Silage.	
Dry Matter ...	23·72	26·32	24·03	24·99	23·69	24·15	82·54
Oil*	1·97	3·26	2·28	3·25	2·28	4·73	1·36
Protein	10·71	9·60	11·98	11·23	14·44	14·88	6·50
Fibre	25·31	30·30	25·58	27·56	23·04	23·71	30·77
Ash	8·18	7·64	10·21	10·09	11·25	10·00	7·18
Carbohydrates ...	53·83	49·20	49·95	47·87	48·99	46·68	54·19

* Extracted with Petroleum Ether B.P. 40-60°C.

It will be noted that the "oil" content is in general lower than that in the analyses for the first year. This is due to the fact that, in analysing the silage of that year, considerable difficulty was experienced in the estimation of the "oil" by extraction with methylated ether. In the second year, therefore, petroleum ether was used for "oil" extraction and was found to be more reliable. The petroleum ether extract is lower than that obtained with methylated ether, but as the same solvent was used for both grass and silage analyses in the second year the results are comparable.

In the dry matter analyses (Table VIII.) it will be observed that the third cutting of grass had a higher oil, protein and ash, and a lower fibre content than the first, while the second cutting gave an analysis approximately intermediate between these two.

The work on pasture grass carried out by Fagan and Jones at Aberyswyth (10) and Woodman, Blunt and Stewart at Cambridge (11) has shown that the younger the grass the richer it is in " oil," protein and mineral matter, and the smaller its fibre content.

As already stated, each cutting was of a different type, the first being more mature than the second, and the second being further advanced in growth than the third. The differences pointed out were therefore to be expected.

The variation in chemical composition of the dry matter of the grass was reproduced in the dry matter of the silage made from each cutting. The percentage of fibre in the silage from the most mature of the three (*i.e.*, the first) was as high as that of the hay. It would appear from these results that, in making silage from pasture grass, stage of growth is a factor which must be taken into consideration. From the comments on the loss in dry matter during ensiling it is needless to emphasise further the avoidance, where at all possible, of filling into the silo a rain-laden crop.

FEEDING EXPERIMENTS.

First Year.

When the silo was opened in November it was found that the silage to a depth of about six inches was damaged and unfit for food. When this was removed the under-lying material was of good quality. It had an olive green colour, a pleasant odour and was readily eaten by cattle of all classes.

It was decided to carry out experiments to see how far grass silage could replace (1) hay, and (2) roots and hay, in rations for cattle. Trials were carried out with calves, fattening cattle and dairy cows.

Silage *v.* Meadow Hay.

Calves.—Sixteen commercial shorthorn calves bred on the farm were selected and divided into groups according to age.

Group 1. Calves 6-8 months old.
Group 2. Calves 8-10 months old.

Each group was then sub-divided into two lots as evenly as possible, taking into consideration sex, age, quality and liveweight, and fed as follows :—

TABLE IX.

Calves 6 to 8 Months Old.

Silage Lot.	Meadow Hay Lot.
35 lbs. Roots.	35 lbs. Roots.
4 lbs. Meal Mixture.	4 lbs. Meal Mixture.
12½ lbs. Silage.	5½ lbs. Meadow Hay.

TABLE IX.—*continued.*

CALVES 8 TO 10 MONTHS OLD.

Silage Lot.	Meadow Hay Lot.
49 lbs. Roots.	49 lbs. Roots.
5 lbs. Meal Mixture.	5 lbs. Meal Mixture.
14¾ lbs. Silage.	6½ lbs. Meadow Hay.

The meal mixture used in the above rations was composed of:—

2 parts Linseed Cake;

1 part Dried Grains;

1 part Maize Meal.

From the previous investigation on meadow-grass silage (2) it was assumed in making up the rations that two pounds of grass silage were equivalent to one pound meadow hay. When the animals had been a short time on the experiment it was found that the silage lot was not receiving sufficient fodder and the silage ration was consequently increased on the basis of two-and-a-half pounds of silage to one pound of hay.

The calves were fed for a preliminary period of fourteen days on the experimental rations after which they were weighed and the experiment proper started. The trial was conducted over a period of seventy-eight days. The animals were weighed individually at fortnightly intervals to ascertain the trend of the comparison.

At the beginning and at the end of their experimental period the animals were weighed on two consecutive days and at approximately the same hour, and the mean of each of the two weighings taken as the initial and final weighings respectively.* A summary of the results is shown in the following tables:—

TABLE X.

Calves 6 to 8 months old.	Average Initial Liveweight.	Average Final Liveweight.	Average Liveweight Increase.	Period of Experiment	Average Daily Liveweight Increase.	Percentage Difference.
	c. q. lb.	c. q. lb.	c. q. lb.	Days.	lb.	%
Silage ...	3 0 24	4 1 1	1 0 5	78	1·50	10
Hay ...	3 1 14	4 2 3	1 0 17	78	1·65	

* The same procedure is adopted throughout all the feeding trials.

TABLE X.—*continued.*

Calves 8 to 10 months old.	Average Initial Liveweight.	Average Final Liveweight.	Average Liveweight Increase.	Period of Experiment	Average Daily Liveweight Increase.	Percentage Difference.
	c. q. lb.	c q. lb.	c. q. lb.	Days.	lb.	%
Silage ...	4 3 9	5 3 1	3 20	78	1·33	6·7
Hay ...	4 3 19	5 3 18	3 27	78	1·42	

When due allowance is made for experimental error contingent to the trial the gain is slightly in favour of meadow hay and the difference is more marked in the case of the younger calves.

Fattening Cattle.—To compare the feeding value of grass silage and meadow hay for older cattle, twenty commercial shorthorn bullocks from two to three years old were selected as being suitable for experimental work and divided into two groups, as evenly as possible. They were then fed on the following daily average rations:—

TABLE XI.

Group I.	Group II.
70 lbs. Roots.	70 lbs. Roots.
9 lbs. Meal Mixture.	9 lbs. Meal Mixture.
32·75 lbs. Silage.	14½ lbs. Meadow Hay.

The meal mixture consisted of:—

1 part Linseed Cake;
2 ,, Palm Nut Cake;
1 ,, Maize Meal;
1 ,, Dried Grains.

In making up the rations silage was at first fed on the basis of two pounds to one pound of meadow hay. As in the case of the calves it was found necessary after a short time to increase the quantity of silage to the basis of two-and-a-half pounds to one pound of meadow hay. There was a preliminary period of fourteen days in order to get the animals accustomed to the different foods and to observe their rate of progress. As they became ready for the butcher during the period of the experiment, they were weighed and marketed, equal numbers being taken from each group. The average experimental period was fifty-six days.

A summary of the results is shown in the following table:—

TABLE XII.

Group.	Average Initial Liveweight.	Average Final Liveweight.	Average Liveweight Increase.	Period of Experiment	Average Daily Liveweight Increase.	Percentage Difference.
	c. q. lb.	c. q. lb.	c. q. lb.	Days.	lb.	
Silage ...	10 1 12	11 2 16	1 1 4	56	2·57	32
M. Hay.	10 2 15	11 2 12	0 3 25	56	1·94	

It will be seen that the silage fed animals gave a higher daily liveweight increase than those fed with meadow hay, the difference being 32 per cent. Even after making due allowance for experimental error the results from silage are distinctly superior to those from meadow hay.

Dairy Cows.—In order to get the comparative feeding values of grass silage and meadow hay for milk production eight commercial shorthorn cows from the College herd were selected and divided into two lots of four each, care being taken to have the two lots as even as possible not only as regards milk yields but also as to date of calving, quality and liveweight.

The experiment extended over ten weeks, which were sub-divided into two periods of five weeks each. At the end of the first period the cows on the silage were changed over to the meadow hay and those on the meadow hay to silage.

The plan of feeding and the average daily rations are shown in the following table:—

TABLE XIII.

Group.	Period Previous to Experiment.	Preliminary Period 7 days.	First Period 4 weeks.			Change Interval 7 days.	Second Period 4 weeks.		
I.	Roots Silage Meals Hay	Silage Meals Roots	Silage lb. 37½	Meals lb. 10	Roots lb. 56	Hay Meals Roots	Hay lb. 15	Meals lb. 10	Roots lb. 56
II.		Hay Meals Roots	Hay lb. 15	Meals lb. 10	Roots lb. 56	Silage Meals Roots	Silage lb. 37½	Meals lb. 10	Roots lb. 56

In making up the above rations two-and-a-half pounds of grass silage were taken as being equivalent to one pound of meadow hay. The meals were fed on a basis of milk yield.

The meal mixture was made up of equal parts of the following:—

Linseed Cake;
Palm Nut Cake;
Rolled Oats;
Bran;
Dried Grains;
Indian Meal.

A constant supply of water was available to the animals by means of automatic drinking bowls.

A summary of the results is shown in the following table:—

TABLE XIV.

AVERAGE DAILY MILK YIELD.

First Period. Silage.				Change Interval.	Second Period. Meadow Hay.			
First week.	Second week.	Third week.	Fourth week.	Fifth week.	Sixth week.	Seventh week.	Eighth week.	Ninth week.
lb.	lb.	lb.	lb.		lb.	lb.	lb.	lb.
24·5	22·7	23·7	22·1		21·5	20·75	21·30	21·6
First Period. Meadow Hay.				**Change Interval.**	**Second Period. Silage.**			
First week.	Second week.	Third week.	Fourth week.	Fifth week.	Sixth week.	Seventh week.	Eighth week.	Ninth week.
lb.	lb.	lb.	lb.		lb.	lb.	lb.	lb.
24·2	23·4	23·4	22·6		21·8	21·3	21·5	20·1

The results of this test point to the conclusion that when due allowance is made for experimental error it may be concluded that two-and-a-half pounds of grass silage could replace one pound of meadow hay in the feeding of dairy cows.

SILAGE *v.* MEADOW HAY AND ROOTS.

On account of the succulent nature of grass silage compared with meadow hay, as already shown by the moisture content set out in the chemical analyses, it was considered desirable to see if silage could replace roots as well as hay in the rations for cattle. Accordingly feeding trials were carried out with calves and with dairy cows.

Calves.—Sixteen commercial shorthorn calves from eleven to thirteen months old and bred on the farm were selected for the test. They were divided into two groups according to age, each group being further divided

as evenly as possible in two lots, and fed on the following average daily rations:—

TABLE XV.

Age of Calves.	Silage Lot.	Meadow Hay and Roots Lot.
Eleven Months.	29·5 lb. Silage. 4 lb. Meal Mixture.	21 lb. Roots. 4 lb. Meal Mixture. 7 lb. Meadow Hay.

Age of Calves.	Silage Lot.	Meadow Hay and Roots Lot.
Twelve to Thirteen Months.	41 lb. Silage. 5 lb. Meal Mixture.	35 lb. Roots. 5 lb. Meal Mixture. 8 lb. Meadow Hay.

The meal mixture used for both groups was composed of:—

1 part Linseed Cake;
1 part Indian Meal.

In making up the above rations, the experience gained in the previous experiments was utilized in balancing the silage and meadow hay. In the case of the roots, however, it was assumed that six pounds of silage were equivalent to ten pounds of mangels, which was the figure obtained in previous experiments (3) on the feeding of the ordinary silage made from beans, peas, vetches and oats.

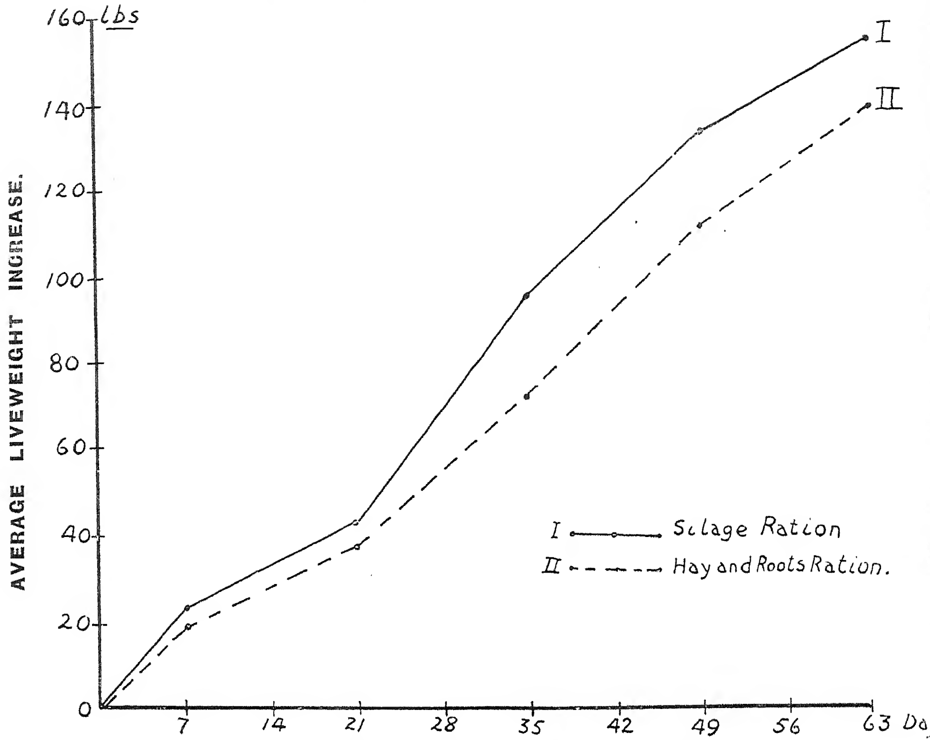
The animals were fed for a preliminary period of seven days after which the experiment proper started. The trial proper extended over a period of sixty-three days. As in the previous experiments the animals were weighed fortnightly.

The following table and the graphs opposite show a summary of the results:—

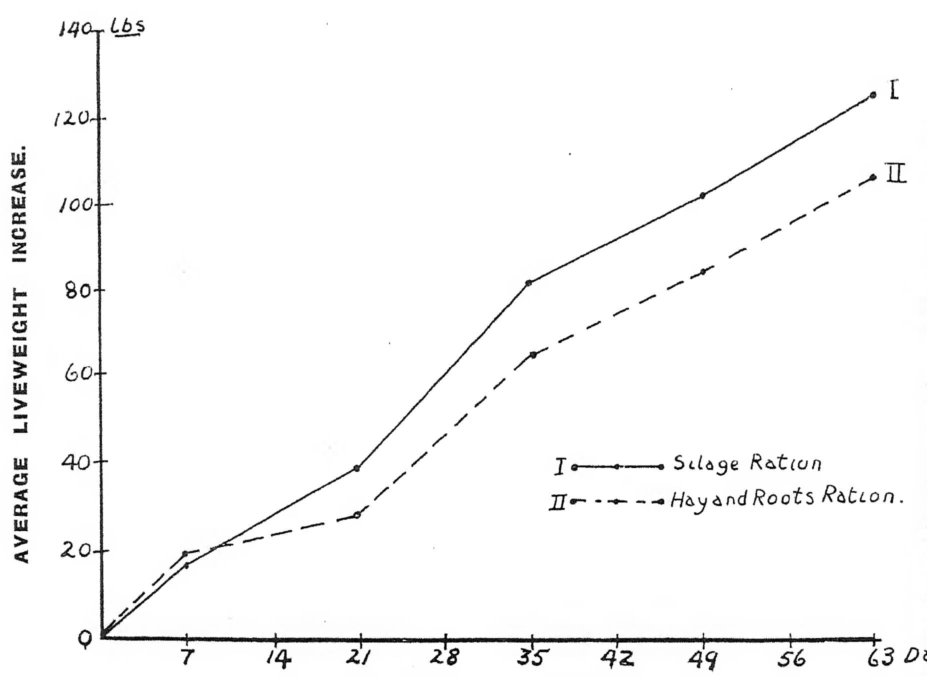
TABLE XVI.

Calves 11 months old.	Average Initial Liveweight.	Average Final Liveweight.	Average Liveweight Increase.	Experi-mental Period.	Average Daily Liveweight Increase.	Percentage Difference.
	c. q. lb.	c. q. lb.	c. q. lb.	Days.	lb.	%
Silage ...	4 2 6	5 2 19	1 0 13	63	1·98	17·85
Hay and Roots.	4 2 24	5 2 18	3 22	63	1·68	

Showing the Average Liveweight Increase.

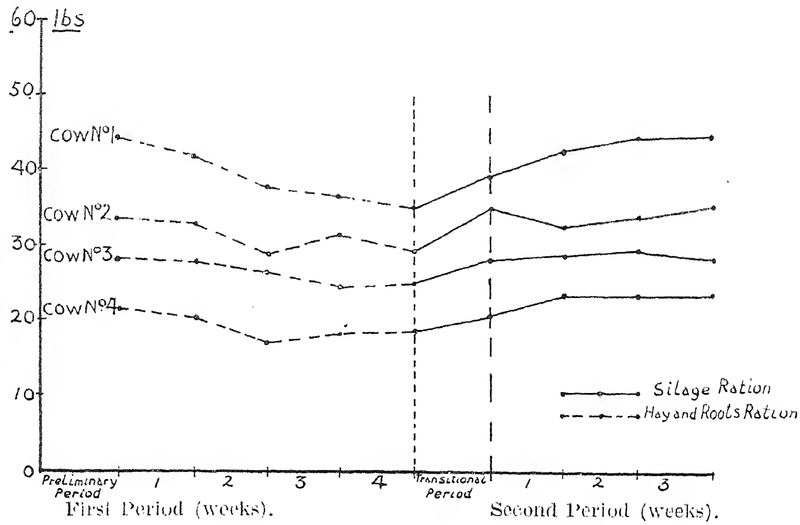


Results for Calves Twelve to Thirteen Months Old.

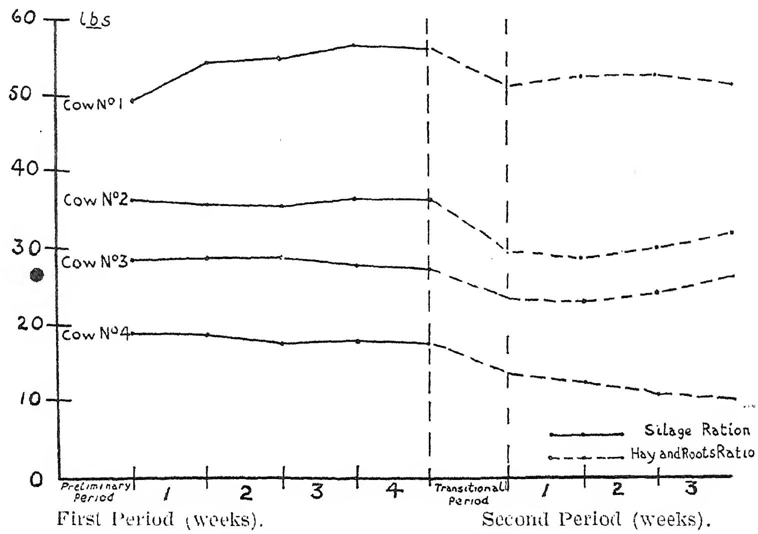


Results for Calves Eleven Months Old.

AVERAGE DAILY MILK YIELDS.



Results for Individual Cows in Group II.



Average Results for both Groups.

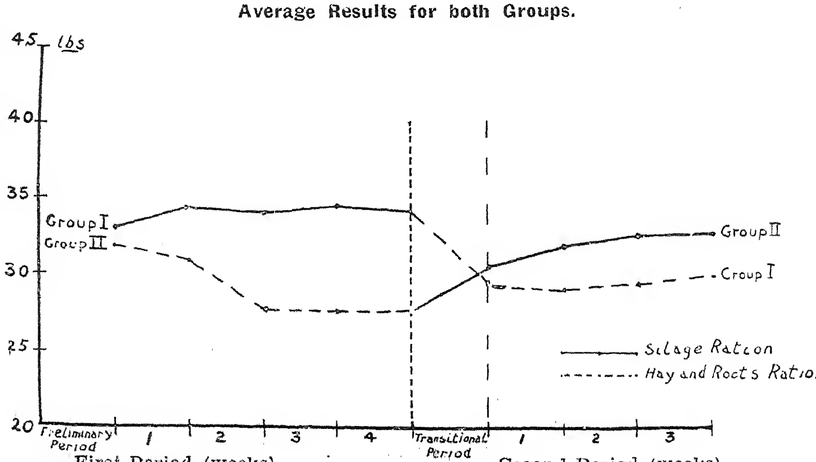


TABLE XVI.—*continued.*

Calves 12 to 13 months old.	Average Initial Liveweight.	Average Final Liveweight.	Average Liveweight Increase.	Experimental Period.	Average Daily Liveweight Increase.	Percentage Difference.
	c. q. lb.	c. q. lb.	c. q. lb.	Days.	lb.	%
Silage ...	5 3 25	7 1 11	1 1 14	63	2·44	11·41
Hay and Roots.	6 0 21	7 1 19	1 0 26	63	2·19	

CONCLUSIONS.

From the foregoing results we see that there is a distinct difference in the average daily liveweight increase in favour of silage. This would indicate that silage has a higher feeding value for calves than that given to it in making up the rations.

A possible explanation of the high feeding value of silage obtained in this trial as compared with that obtained in the trial where it replaced hay only, is that in the latter case too much bulky food was consumed by the animals. In one case the calves were given 35 lb. roots plus 12½ lb. silage—total bulky food 47½ lb. against 29.5 lb. silage fed to somewhat older calves in this trial. In the second lot of calves 49 lb. roots plus 14¾ lb. silage—total bulky food 63¾ lb. was fed as against 41 lb. silage fed to the calves in this test.

The result of this experiment indicates that 8½ lb. grass silage has a higher feeding value than 10 lb. mangels plus 1 lb. meadow hay.

Dairy Cows.—This experiment was carried out on similar lines to the previous trial with dairy cows except that silage now replaces roots as well as hay in the ration.

Eight commercial shorthorn cows were selected from the College herd and divided into two comparable groups. The experiment extended over nine weeks, which was divided into two periods of five and four weeks respectively. At the end of the first period the rations were interchanged as in the previous trials with dairy cows. A change over period of seven days was allowed to get the animals accustomed to their new feed in each case.

The plan of feeding and the average daily rations fed are shown in the following table:—

TABLE XVII.

Group.	Period Previous to Experiment.	Preliminary Period 7 Days.	First Period 4 weeks.			Change Interval 7 Days.	Second Period 3 weeks.		
			Silage		Meals	Hay.	Hay	Roots	Meals
I.	Roots. Silage. Meals. Hay.	Silage.	lb.		lb.	Roots.	lb.	lb.	lb.
		Meals.	71		10	Meals.	15	56	10
		Hay.	Hay	Roots	Meals		Silage		Meals
II.		Roots.	lb.	lb.	lb.	Silage.	lb.		lb.
		Meals.	15	56	10	Meals.	71		10

In making up the above rations the silage was fed on the basis of:—

$2\frac{1}{2}$ lb. silage being equivalent to 1 lb. meadow hay.

6 lb. ,, ,, ,, ,, 10 lb. mangels.

$8\frac{1}{2}$ lb. ,, ,, ,, ,, 10 lb. mangels plus 1 lb. hay.

During the first period of the experiment the cows in both lots cleaned up all their food, but when the rations were interchanged some difficulty was experienced in getting the animals in both lots to eat all their ration. This was probably due to the experiment extending into the middle of May, when the foods were becoming somewhat dried, and to the fact that the animals were being housed in the same byre where the main part of the herd was coming in twice daily from the pastures for milking. To get over this difficulty it was decided to moisten both rations with a little treacle, this had the desired effect as the cows then ate all their food.

The following table and the graphs facing p. 15 show a summary of the results:—

TABLE XVIII.

AVERAGE DAILY MILK YIELD.

Preliminary Period.	First Period. Silage.				Change over Period.	Second Period. Hay and Roots.		
First week.	Second week.	Third week.	Fourth week.	Fifth week.	Sixth week.	Seventh week.	Eighth week.	Ninth week.
lb.	lb.	lb.	lb.	lb.		lb.	lb.	lb.
33·0	34·3	34·0	34·6	34·2		28·9	29·3	29·9
Preliminary Period.	**First Period. Hay and Roots.**					**Second Period. Silage.**		
First week.	Second week.	Third week.	Fourth week.	Fifth week.	Sixth week.	Seventh week.	Eighth week.	Ninth week.
lb.	lb.	lb.	lb.	lb.		lb.	lb.	lb.
32·0	30·9	27·7	27·7	27·6		31·6	32·5	32·6

From the foregoing results it can be seen that there is a decided difference in the average daily milk yield in favour of silage, which would indicate that 8½ lb. of silage has a higher feeding value than 10 lb. mangels plus 1 lb. meadow hay for milk production.

As in the case of the feeding experiment with calves, this high feeding value compared with that obtained in the trial where it replaced hay only, may be largely due to the difference in the quantities of bulky food fed in each case. Where silage replaced hay only in the rations, the quantity of roots plus silage fed was 93½ lb. While in this test where it replaced hay and roots the quantity of silage fed was only 71 lb. per cow per diem.

FEEDING EXPERIMENTS.

SECOND YEAR.

The experiments conducted in the first year indicated that 8½ lb. of grass silage more than replaced 10 lb. mangels plus 1 lb. meadow hay when fed to calves and dairy cows. It was considered desirable, therefore, to carry

out further trials to see how silage might replace concentrated foods as well as hay and roots in the ration. Accordingly feeding experiments were carried out with calves and fattening cattle with that object in view.

In conducting feeding experiments a difficulty often arises owing to the foods under comparison not being uniform in composition. This is more particularly the case with a food such as silage where the percentage of dry matter varies with the stage of growth of the crop ensiled, as will be seen from the tables of chemical analyses, and with seasonal and storage conditions. In order to overcome this difficulty it was decided in the second year to feed the rations under comparison on a dry matter basis. The dry matter content of the silage, as it was taken from the silo was therefore determined at fortnightly intervals, and the percentage dry matter of the mangels and meadow hay at less frequent periods. The rations were then adjusted accordingly.

Calves.—Twelve commercial shorthorn calves bred on the farm were selected for this test and divided as evenly as possible into three groups. They were then fed for a preliminary period of fourteen days on the following daily rations.

TABLE XIX.

Lot I.	Lot II.	Lot III.
35 lb. Roots. 6 lb. Meadow Hay. 4·5 lb. Concentrates	38·5 lb. Silage. 70% of the Concentrates fed to Lot I.	38·5 lb. Silage. 90% of the Concentrates fed to Lot I.

The mixture of concentrates used was composed of:—

2 parts wheat;

2 ,, oats;

1 ,, linseed cake.

In making up the above rations the quantity of silage fed was such that it supplied an equal quantity of dry matter to that fed in the roots and meadow hay.

The trial extended over sixty-three days during which time the animals were weighed at fortnightly intervals to ascertain the trend of the comparison.

A summary of the results is shown in the following table:—

TABLE XX.

Groups.	Average Initial Liveweight.	Average Final Liveweight.	Average Liveweight Increase.	Period of Experiment	Average Daily Liveweight Increase.
	c. q. lb.	c q. lb.	c. q. lb.	Days.	lb.
I. Roots, Hay and Concentrates ...	4 2 26	6 0 19	1 1 21	98	1·64
II. Silage and 70% Concentrates ...	4 2 27	6 0 0	1 1 1	98	1·44
III. Silage and 90% Concentrates ...	4 2 24	6 0 17	1 1 21	98	1·64

These results tend to show that the rations fed to Lots I. and III. possessed about an equal food value and indicate that silage effected a saving of ten per cent. in the quantity of meals fed to Lot I.

Fattening Cattle.—Thirty-six commercial shorthorn bullocks from two to three years were selected and divided into four lots as evenly as possible and fed on the following daily rations:—

TABLE XXI.

Lot I.	Lot II.
70 lb. Roots. 7 lb. Concentrates. 12 lb. Meadow Hay.	76 lb. Silage. 4·9 lb. Concentrates.
Lot III.	**Lot IV.**
76 lb. Silage. 5·6 lb. Concentrates.	76 lb. Silage. 6·3 lb. Concentrates.

The concentrates fed lots II., III. and IV. were 70 per cent., 80 per cent. and 90 per cent., respectively of quantity fed to Lot I.

The mixture of concentrated food was made up as follows:—

2 parts Rolled Oats;
2 ,, Rolled Wheat;
1 ,, Decorticated Cotton Cake.

As in the case of the trial with young calves the silage was balanced with roots and hay on a dry matter basis.

During the period of the experiment as the animals became ready for the butcher they were weighed and marketed, an equal number being taken from each group.

A summary of the results is shown in the following table:—

TABLE XXII.

——	Average Initial Liveweight.	Average Final Liveweight.	Average Liveweight Increase.	Average Experimental Period.	Average Daily Liveweight Increase.
	c. q. lb.	c. q. lb.	c. q. lb.	Days.	lb.
I. Roots, Hay + Concentrates ...	10 0 20	11 2 5	1 1 13	78	1·96
II. Silage + 70% Concentrates ...	10 0 18	11 2 5	1 1 15	78	1·99
III. Silage + 80% Concentrates ...	10 0 15	11 2 8	1 1 21	78	2·06
IV. Silage + 90% Concentrates ...	10 0 3	11 2 3	1 2 0	78	2·15

These figures indicate that silage, while replacing hay and roots on a dry matter basis for fattening cattle, will also effect a saving in the quantity of concentrates usually fed. Rations I. and II. gave equal results and if ten per cent. be allowed for experimental error, silage would still show a saving in concentrated food stuffs of twenty per cent.

PIT SILAGE.

Many farmers are not in a position to lay out the capital necessary for the erection of a tower silo and for the installation of machinery for the ensiling of green forage crops. Consequently it was decided to conduct a preliminary investigation into the problem of ensiling grass in pits, in order to see if ensiling could be brought within reach of every farmer.

This investigation was carried out in two directions (*a*) the grass was chaffed before going into the pit and (*b*) it was placed in the pit just as it came from the field. For this purpose, therefore, two improvised pit silos each capable of holding about six tons of grass were made. The site chosen allowed free drainage through an outlet at the bottom of the silos. As the grass was placed in the pits it was well trampled to compress it as much as possible, an operation which proved more difficult in the case of the unchaffed grass. A few days after filling the pits were covered with a heavy layer of clay to further compress the material and to exclude air.

While this experiment was carried out on a small scale the results obtained are sufficient to indicate that trials on a larger scale are worthy of serious attention and it is proposed to pursue this line of investigation more fully during the coming season.

SUMMARY.

The results of the investigations on the production and feeding of grass silage may be briefly summarized as follows:—

1. Pasture grass can be suitably converted into silage.

2. The yield of grass and therefore the yield of silage can be increased by suitable manuring.

3. The quality of the silage produced depends upon:—

(*a*) The stage of growth of the pasture plants, the best results being obtained from grass in an early stage of growth.

(*b*) The method of storing. Good results are obtained where the grass is ensiled in a modern tower silo, though it is probable that silage of good quality can also be produced in pits.

(*c*) Weather conditions at the time of filling the silo. As far as practicable the grass should be cut in dry weather and carted to the silo immediately. If a rain laden crop is put into the silo there is excessive drainage, and consequent considerable loss of nutrient matter from the silo. On the other hand, if the material is very dry, owing to maturity or prolonged wilting, it cannot be tightly packed in the silo and the conditions set up favour the development of moulds with resultant spoiling of the silage.

4. The various feeding trials carried out indicate that:—

(*a*) Silage of good quality is much relished by all stock.

(*b*) Silage is superior in feeding value to meadow hay and roots where it replaces them on a basis of 8½ lbs. grass silage to 10 lbs. mangels plus 1 lb. meadow hay. In the case of dairy cows silage appeared to stimulate the flow of milk.

(*c*) Where silage replaced hay and roots on a " dry matter " basis in the rations for calves and fattening cattle it effected a saving in the quantity of concentrates fed, more particularly in the case of fattening cattle.

5. From the results of these feeding trials, an acre of pasture grass converted into silage and yielding 10¼ tons is superior in feeding value to 12 tons mangels plus 1¼ tons meadow hay.

The foregoing summary applies to grass silage only, as distinct from meadow silage where the crop is in an advanced stage of growth before going into the silo.

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THE ATHLONE SEED POTATO TRADE: ITS ORIGIN, DEVELOPMENT, AND POSSIBILITIES.

By PATRICK KEENAN.

It is difficult to say how and when the seed potato trade in Athlone first originated. There is, however, sufficient evidence to show that it is of long standing, and that potatoes grown in that area were sold for seed purposes in other districts over half a century ago. It was early observed by those engaged in the cultivation of the potato crop that seed produced in bog or peat soils invariably gave good results when subsequently grown in clay or loam, and as Athlone was well situated in the matter of transit facilities (having two waterways, the river and the canal, as well as two lines of railway), it is not surprising that the seed grown in the bogs around it soon obtained a reputation and a market more than local.

In the late sixties several local traders were engaged in a small way in sending seed to Limerick and other towns of the South; but the first person who appears to have realised the possibilities of the locality as a seed centre was a merchant named Ferrier, who opened a general agricultural store in Athlone about 1873. He had gained some practical experience of handling and marketing seed in Scotland, and he determined to attempt the development of seed-growing on a commercial scale. To this end he embarked upon an extensive scheme of advertising which gave a considerable fillip to the trade. He also introduced new varieties from time to time, and he kept well in touch with the demands of the market.

It is probable that it was with the old variety "Flounder" that the earliest export commenced. At all events it is clear that that variety was cultivated almost exclusively for a good many years. It is still grown in the district, but in ever diminishing acreage. "Beauty of Hebron" and "Early Rose" were also grown in small quantities and are still in cultivation, showing remarkable health and vigour after 50 years continuous cropping in the same kind of soil.

In pre-war days, prices did not reach a very high level, except during scarce seasons. "Flounders" always fetched the best price, often realising £1 per ton more than "Early Rose" or "Beauty of Hebron." In 1907 "Flounders" made from £3 to £4 and "Early Rose" £3, and in 1908 "Early Rose" and "Beauty of Hebron" were sold at £4 per ton, and "Flounders" at £5 to £5 10s. 0d., but about that time it seldom happened that any one grower had more than two or three tons to dispose of in the season. Present day prices compare favourably with these, even if allowance is made for the decreased purchasing power of money.

With the decay in popularity of the "Flounder," there set in a decline in the export trade. The spread of a number of varieties in the district, some of them of doubtful purity from the first, and—to the eye of the inexperienced grower—resembling one another in foliage or tuber, led to stocks becoming more or less mixed. One or two of the merchants endeavoured, as best they

could, to keep up the standard of purity by rigorous supervision of seed coming into the stores. But this method could only be satisfactorily employed with varieties showing marked differences, such as colour in the tubers, and at the best could effect but a slight improvement.

The advent of the world-war gave the trade a fresh impetus. Prices rose rapidly, and the demand for seed potatoes raised in bogland soon out-ran the supply. Large profits were realised with such heavy-cropping varieties as "Epicure," which sold at £8 to £12 per ton, and in consequence growers quickly increased the acreage under potatoes. But the benefits derived from this war-time prosperity were short lived, and ultimately proved more of a curse than a blessing to the trade. New buyers of potatoes commenced operating in every direction, and were more concerned about the immediate profits to be made during the period of scarce food supplies than for the building-up of an industry on sound lines. The manner in which the trade was carried on did not tend to enhance the name of Athlone seed, and the older firms with a reputation to sustain found it very hard to cope with the situation or to carry on business at all.

When the war terminated and other supplies became available, prices fell and trade declined. Moreover, most growers had got their stocks so badly mixed that the merchants found it impossible to give any guarantee of purity with the smallest consignment of seed. From these and other causes the industry had reached a low ebb when, in the summer of 1923, an effort was made to induce farmers to revive the industry by the adoption of better methods.

The Department were satisfied that the growing of potatoes for seed purposes in the Athlone district offered ample possibilities of revival and development. The soil was suitable, the district well situated in the matter of accessibility to markets, and there existed a long tradition of seed-growing. These conditions provided the nucleus around which an attempt to build up a flourishing industry was made. The original market having been lost, the first necessity was to find a new market, and then to endeavour to meet its demands. The home market was at the door, but for a number of years back it had for the most part been supplied from Scotland—many thousands of pounds being sent out of the country annually for seed requirements in all the 1st and 2nd earlies, and in many of the main crop varieties as well. It was felt that at least part of this trade might be secured for Athlone. The varieties in demand, however, would need first to be made available.

It was found that of these the only one grown in any quantity in the Athlone district was "Epicure." The variety "British Queen," for which there was, and is, such a demand in County Dublin, was grown only in small lots, often mixed, and still oftener confused with the variety "Abundance." The latter was also dubbed "Puritan," and the genuine Puritan mis-named "Duke of York." There were small quantities of "Early Rose" and "Beauty of Hebron," but nothing else of importance.

It was evident that the first step to be taken was to purify the existing stocks, where possible, and to supplement these by introducing new and healthy ones. The next was to bring in foundation stocks of the new varieties most in demand. Both of these measures were adopted and carried out with

as much despatch as possible. A very healthy stock of "British Queen" was imported from the North of Scotland, and this, along with the small purified stock in the district, sufficed, in two years' time, to produce ample supplies of that variety for the Irish market. Stocks of "May Queen," "Duke of York," and "Great Scot" were also imported.

Experimental plots were laid down to determine the cropping capacity of the different varieties on bog soil in the district. Elsewhere tests were carried out to determine the relative yields from crops planted with seed potatoes from Athlone, Scotland, and other sources, and the publication of the results (which were generally in favour of the first-named), gave an impetus to the demand for Irish-grown seed, particularly for that grown on bog soil.

Demonstrations were conducted to prove the utility of artificial manures, till then little used in the district. Spraying tests were carried out where very little spraying had been done previously. Special rates were obtained for the carrying of certified seed by rail and canal. Meetings and conferences were held to which buyers were invited, and the merits of the bog-grown seed were brought before the trade in general. Precautions were taken by means of numbering, branding and sealing the bags to ensure that no other seed could be foisted on the buyer as Athlone certified seed. Meantime, a continuous effort was made to improve the stocks in respect of purity of variety and freedom from disease, and to raise the standard of quality. In addition to the educational activities they set in motion, the Department appointed a full-time officer to carry out the necessary work of inspection and supervision at the seed stores and elsewhere in the Athlone area. It will thus be seen that no effort was spared to revive and foster the industry. The results obtained in a comparatively brief period have fully justified these measures.

The growers of the district responded well to the Department's educational efforts. In 1923 only one-third of the crops grown for seed could be certified as reasonably pure, and 165 tons were sent out in sealed packages. By 1925 practically all the crop was passed pure, and 1,200 tons of certified seed were sent out during the following Winter and Spring. About 100 growers were visited in the former year and 300 in the latter. The acreage increased rapidly as the old growers extended their tillage and new ones came in. The use of artificial manures was quadrupled, and spraying was carried out in the district in a most satisfactory way.

The merchants in like manner helped with the work. As soon as a reasonable supply of certified seed was available, they refused to handle any other, even from their old customers. Every effort was made to get consignments sent out in proper condition in bags of improved quality, properly sewn and clearly branded. Wet and dirty seed was objected to, and the quality, grading, and appearance of the seed put up were greatly improved. All this, of course, was not accomplished at once; it had of necessity to be brought about very gradually. To attain a high standard it was necessary to educate and train both merchant and grower: to create a public spirit eager to produce and send out nothing but the very best. This became easier as the benefits from the improved measures began to be felt.

By the Spring of 1926, Athlone had captured the greater part of the home market for seed of early varieties, and, through the aid of the Department,

had been able to introduce a small quantity (about 30 tons) of seed into England. It was evident that no hope could be entertained of any big development in the industry unless a secure foothold could be obtained in the British markets, where vast quantities of seed are required annually. The annual demand for home requirements could probably be completely supplied by 3,000 tons. Attention was, therefore, directed to the English market. Agricultural and other Shows in Great Britain were visited, and the Department assisted by obtaining space for the erection of stands for displaying samples of seed at some of the principal centres at which buyers are to be met—notably Birmingham and Smithfield. Athlone merchants attended at these stands, and on their first visit they sold about 30 tons of seed potatoes.

To meet this new trade, stocks of "King Edward," "Sharpe's Express," and "Eclipse," varieties popular in England, were imported and distributed among the growers. In the following year (1927), Athlone merchants were in a position to place some of the produce of the seed which had been imported on the market, and about 100 tons of these varieties were disposed of. It was gratifying to find that seed sent over in the previous year had proved very satisfactory, and that purchasers were prepared to try it again. In the summer of that year several English merchants visited Athlone district to see for themselves the vigour and purity of the growing crops.

Late in 1927, two of the English Shows were again visited, with most successful results. Purchasers came along in plenty, and most of the previous year's customers stated that the seed sent over had realised all their expectations in regard to grading and quality and had given good results in the crops produced. Orders for over 600 tons were met by the end of the season, and these orders could easily have been doubled but for the very limited supplies of the more recently introduced varieties, notably "Sharpe's Express," "May Queen," and "Duke of York."

In response to representations made by the Department, the Railway and Shipping Companies helped considerably by conceding specially reduced freight charges, and through rates were quoted which facilitated the despatch of consignments right through to a number of ports and stations in England. As the industry grows, further reductions in freight charges may confidently be anticipated.

The season of 1927–28 marked another substantial advance in the seed trade. Over 2,000 tons, consisting of nearly twenty different varieties, were sent out to all parts. During one week in the early spring, over 300 tons were put on rail or boat—a quantity about equal to a whole season's output for the district some years ago, and most of which had at that time to be graded in the stores.

In the summer of 1928 about 450 growers had their crops certified for seed. The area had increased, though the season was anything but a favourable one for bogland owing to the continuous wet weather and the widespread prevalence of blight. Still, the unremitting attention given to spraying had its effect, and though the yield was reduced, the crop gave, in most cases, a fair return. Over 2,200 tons of seed were sent out, including about 500 tons exported to Cross-Channel markets. This quantity represented all that could be spared after the needs of the home market had been met. It was an en-

couraging fact that, before the market had properly opened, English merchants who got seed from Athlone previously, came along again to purchase supplies in large quantities, so that several varieties were sold out before any Show had been visited. The demand, in many cases, has thus come to exceed the supply, and Athlone seed, where it is known, can now command prices as high as the best Scotch. But while it is satisfactory to be able to obtain top prices, it is of far more importance to secure a steady market for the grower's produce. This is well illustrated by the change in the Athlone trade, which languished during a period of high prices but uncertain markets, and is now prospering with moderate prices but steady continual demand and almost certain sale.

Prices paid to the grower for seed of the following varieties sent to England last year were as follows :—

	£ s.		£ s.
Epicure ...	4 0 per ton.	British Queen ...	5 10 per ton.
Great Scot ...	4 10 ,,	Sharpe's Express ...	6 5 ,,
King Edward ...	5 0 ,,	Early Rose and Beauty of Hebron	6 10 ,,
Eclipse ...	5 0 ,,	May Queen	8 0 ,,

It will be noted, as mentioned early in this article, that "Early Rose," the only one of these varieties produced in the district before the war, realised in those days only £3 per ton.

In this connection it may be of interest to note the actual sums paid for seed to a few growers in the Athlone area. It should be remembered that by far the greater part of the land on which these crops are raised is bog-soil of the poorest quality in its natural state, and utterly unfit to produce anything but wild heath if left to itself.

The following figures give some indication of the return in money received for such potatoes by growers on small holdings of bogland in the past season :—

Grower.	Approximate area of arable holding.	Received for seed potatoes sold.	Grower.	Approximate area of arable holding.	Received for seed potatoes sold.
	Acres.	£ s. d.		Acres.	£ s. d.
"A" ...	7	55 8 6	"E" ...	34	229 13 0
"B" ...	4½	54 0 0	"F" ...	7	84 11 0
"C" ...	10	125 18 0	"G" ...	7	104 5 9
"D" ...	8	62 13 0	"H" ...	6	77 6 9

Approximately, £12,000 in all was received for seed potatoes sold in the Athlone district last season.

Further schemes for development are in progress or under consideration. In this connection transit is an important factor. During the past two years Grand Canal boats with a 40–50 ton capacity were utilised for the conveyance

of seed, consigned to England, to the Cross-Channel boats at North Wall, and recently the Canal Company have erected a new store alongside the docks at Athlone which will be utilised principally for warehousing and grading seed potatoes during the coming season. It is expected that boats of smaller capacity than those referred to will be used to collect potatoes along both banks of the Shannon as far as Shannonbridge, and for conveying them to the Stores. The improvement of existing roads and the construction of new roads giving access to remoter reaches of the bog are being undertaken, thus providing facilities for the conveyance of potatoes by motor lorry to the quay and railway sidings. New stores being erected by merchants in proximity to the railway station will greatly relieve the congestion which occurs during the busy season, and afford increased facilities for speedy handling and loading.

It cannot be doubted that plenty of scope exists for further development when the requirements—about 200,000 tons annually—of the English seed market are considered. Of this quantity of seed, only about 2,000 tons are supplied from all parts of the Saorstat, and there is no reason, provided the varieties in demand are forthcoming and the seed is properly selected and graded, why the relatively small quantity at present exported could not be multiplied many times.

Extensive areas of bogland, well suited for growing seed potatoes, await development, not only in the neighbourhood of Athlone, but in other parts of the country. The return from much of this land is at present negligible, whereas, if utilised for the production of seed potatoes, it is quite capable of bringing in as good returns to the growers as those which have been indicated above.

THE DRY ROT OF SWEDES AND TURNIPS CAUSED BY PHOMA LINGAM (TODE) DESM.

(PROGRESS REPORT).

By PAUL A. MURPHY, Sc.D., Professor of Plant Pathology, University College, Dublin, and WM. HUGHES, B.AGR.Sc.

The question whether the fungus responsible for dry rot of swedes and turnips, *Phoma Lingam* (Tode) Desm., occurs on the seeds of the swede turnip (*Brassica Rutabaga L.*), and if so, if it is present in sufficient quantity to account for much of the dry rot which frequently develops in the crop, has recently been the subject of investigation. The importance of this question to seed-growers and farmers is such as to justify the present preliminary account of the more directly applied side of our work on this disease, reserving more technical details for a future publication.

It is not necessary for present purposes to go into details concerning the earlier work on the subject. So far as the question of the hibernation of the parasite was considered at all, it was thought that infection was soil-borne.[1] The experience of swede-growers seemed to point in the same direction, for it has been generally held that the disease is apt to be most serious when one swede crop follows another, either immediately or after a short interval. A recent instance of this has been described by Cotton in England.[2] The fact that the disease may persist on the decaying remnants of affected roots and even leaves, whether these are left in the field or are returned to it in farmyard manure when the roots decay in storage, is an obvious possibility which suggested itself to various workers, among whom Potter[3] may be mentioned.

The fact that *Phoma lingam* sometimes occurs in the seed-coat of swede seeds was first announced by Cunningham[4] in New Zealand in 1927. At the same time Cunningham proved that the fungus was capable of surviving out-of-doors in the remains of diseased roots, but apparently not in soil which had recently grown a diseased crop. Cunningham believed that the parasite was capable of surviving only for a limited period in such affected roots lying on the surface of the soil, the complete decay of the root putting an end to its existence. He strongly emphasised the practical importance of seed-borne infection, and believed that if disease-free seed were made available in New Zealand, to the exclusion of all other seed, a rotation of one year would practically rid that country of the disease.

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1 Levy, E. B.—Dry-rot of Swedes Investigation. N. Z. Journ. of Agric. XXI: 233–243 1920; and XXIV: 330–343, 1922.

2 Cotton, A. D.—Fungus Diseases of Crops, 1920–1921. Min. Agric. and Fish. (England), Misc. Pub. No. 38, 1922.

3 Potter, M. C.—A new Phoma Disease of the Swede. Journ. Bd. of Agric. (England), VI: 448–456, 1900.

The importance of Cunningham's discovery of the dry rot fungus in swede seed should not be overlooked, although we have not been able to confirm some of his other and more technical conclusions. This is not the place to go into the details of the latter question, but a short summary is essential to an understanding of the situation.

Cunningham's[1] conclusions may be summarized as follows:—

(1) *Phoma lingam*, the cause of dry rot, consists of three principal strains, one (Strain III) being non-pathogenic, one (Strain I) weakly parasitic, and the third (Strain II) strongly parasitic. The last was found chiefly responsible for dry rot in New Zealand.

(2) *Phoma lingam* is seed-borne. The strongly parasitic Strain II was found on swede seed in New Zealand, but the only fungus mentioned as having been found on English (or Danish) seed belonged to the weakly parasitic Strain I, a fact which has given rise to some misunderstanding.

(3) Imported contaminated seed is held largely responsible for the large amounts of dry rot which develop in New Zealand.

The position which was taken up by the senior author,[2] based on an examination of representative cultures of Cunningham's principal parasitic strains, in comparison with cultures isolated in Ireland, was in short as follows:—

(1) Cunningham's Strain II corresponds to *Phoma lingam* as it occurs in rotting swede roots in Ireland, and it is the principal cause of dry rot in this country also. Some of the fungi representing Strain I are species of *Phoma*, but others have no connection with this fungus. (The non-parasitic Strain III was not examined, as it was not represented in our cultures.)

(2) Apparently in confirmation of Cunningham's conclusion (see (2) above), the fungi which were found commonly on Irish and English seed corresponded to the non-Phoma types included in Strain I; while according to our then (June, 1928) "limited experience," no species of *Phoma* was found on the seed.

(3) It would be premature to suggest that *Phoma lingam* never occurs on British seed; but even if it does, the question arises if it is present in sufficient quantity to account for all the disease which develops, or if other sources of infection should not be looked for.

The question involved in (1) above we are not directly concerned with at present, except to say that further experience confirms our original contention that some of the fungi included in Strain I which occur commonly on swede seeds are not connected with *Phoma lingam* or with dry rot. The recognition of this fact materially reduces the apparent amount of seed contamination.

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[1] Cunningham, G. C.—Dry-rot of Swedes and Turnips: Its Cause and Control. N. Z. Dept. of Agric., Bul. No. 133, 51 pp., 1927.

[2] Murphy, P. A.—The Connexion between Dry-rot of Swedes in New Zealand and British Seed. Nature, July 7th, 1928.

The present paper deals more particularly with the other two points mentioned—namely, the occurrence of *Phoma lingam* on swede seeds, and the possibility that sources of infection other than the seed exist, and are a factor in producing re-current outbreaks of the disease.

Occurrence of Phoma Lingam on Seeds of Swede Turnips.

As already stated, our preliminary work had failed to discover any *Phoma Lingam* on swede seeds, although a species of *Alternaria* and one of *Macrosporium* were very frequently encountered. During the summer of 1928, however, four separate lots of seed of the same variety were placed at our disposal by a firm of seed-growers and exporters, and in one of these a fairly considerable number of seeds produced growths of the dry-rot fungus. The procedure followed in examining the seeds was slightly modified from that given by Cunningham: a true sample was taken from the lot to be examined, and the seeds in lots of 50 or 100, after superficial disinfection in mercuric chloride 1:1000 for 10 minutes and rinsing in sterile water in a special glass tube fitted with a perforated cap, were transferred direct to set plates of potato glucose agar (containing 2 per cent. of agar) in Petri dishes. The plates were incubated at 21°C. Every fungus colony originating from a seed was isolated and grown in pure culture until its identity was established. It was ultimately found that the colonies of *Phoma Lingam* were usually, but not always, sufficiently developed to allow of being transferred from the original plate on the third day, while the other fungi were usually transferred on the fourth and fifth day. Cultures containing *Phoma* were readily recognised by the presence of pycnidia, and their identification was confirmed by comparing them with a stock culture of *Phoma Lingam* isolated from a single conidium from a root showing typical dry-rot. Furthermore, all the original *Phoma* isolations were inoculated into swede roots.

The following Table shows in detail the number of cases in which *Phoma Lingam* and other fungi, respectively, were isolated from the four lots of seed mentioned:—

OCCURRENCE OF PHOMA LINGAM AND OTHER FUNGI ON SEEDS OF SWEDE TURNIPS.

Seed Lot Number	Number of Seeds Examined.	No. of seeds which developed colonies of:—			
		Phoma Lingam.	*Alternaria.*	*Macro-sporium.*	*Other Fungi.*
25	5,000	0	6	28	1
26	5,000	0	0	0	10
28	5,000	10	3	0	0
60	5,000	0	2	4	0

All the cultures of *Phoma Lingam* isolated from the seed were of the same type, and there is no doubt that all were identical. The first five isolations were more particularly compared with *Phoma Lingam* isolated from swede leaves from two different sources in the Irish Free State, and with Cunningham's strain, No. 491 B, of the same fungus. Following inoculations into swede roots, with controls, in the laboratory, lesions developed about all the wounds within ten days, and typical dry rot developed at about the same rate in all cases. The following table shows the details of this comparison:—

COMPARISON OF *PHOMA LINGAM* FROM VARIOUS SOURCES.

Description and source of culture.	No. of days in which lesion developed.	Size of lesion after 106 days.	Recovery from lesion.	Further identification of fungus recovered.
S 1 from seed ...	10	30 x 40 mm.	+	The four re-isolated cultures were compared with *Phoma Lingam* (originating from swede roots) on plates of potato glucose agar, and all were found identical in growth, and all produced pycnidia and conidia of the same type within 12 days.
S 2 do. ...	10	40 x 50 mm.	*	
S 3 do. ...	10	40 x 20 mm.	+	
S 4 do. ...	10	45 x 25 mm.	*	
S 5 do. ...	10	35 x 40 mm.	*	
L 1 from leaf ...	10	45 x 35 mm.	+	
L 2 do. ...	10	40 x 25 mm.	*	
491 B from N. Z.	10	30 x 25 mm.	+	
Control ...	—	—	—	

*Recovery was not undertaken in these cases.

The following facts are therefore established or confirmed:—

(1) *Phoma Lingam* occurs on swede seeds, as well as on swede leaves, and the fungus isolated from both these sources is identical in its morphological characters and pathogenic capacity with the fungus as it occurs on swede roots showing dry rot.

(2) *Phoma Lingam* occurs on British-grown swede seed.

(3) The fungus which usually causes dry rot in Ireland is identical with the form of the fungus held by Cunningham to be chiefly responsible for dry rot in New Zealand.

Persistence of the Parasite on old decaying Roots in the Soil.

It had already been proved during the earlier phase of this work that the parasite can persist on old decaying roots in the soil, and from this source can infect a new crop in the following year.

In December, 1926, a number of roots attacked by dry rot were chopped up and spread on the surface of a small plot in a wire cage used for plant

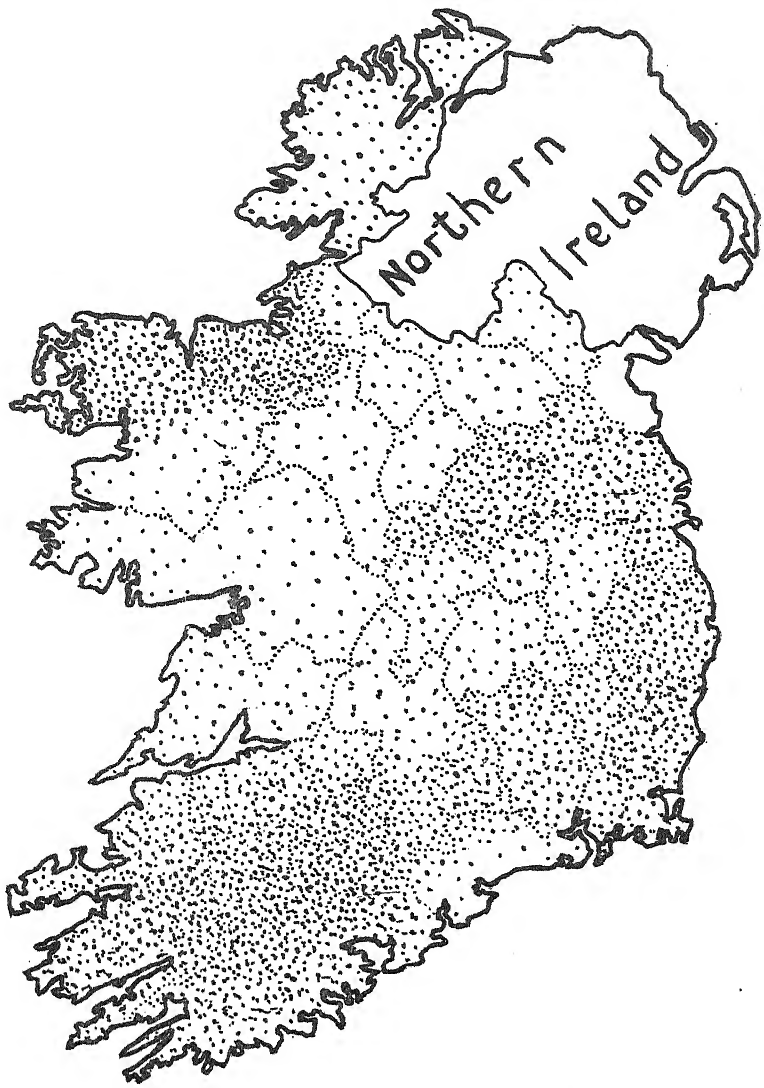

Fig. 1.—Distribution of dry rot in the Irish Free State in 1926.

The disease was most prevalent in the deeply shaded areas. No particulars were available from Co. Louth.

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breeding experiments in which swedes or turnips had not been grown for many years. These were subsequently dug into the ground, and in the following May swede seed was sown in this plot, and in another similar small plot at the other end of the same cage to which no roots had been added. The distance between the plots was about 27 yards.

The plants in the contaminated plot were more uneven in development throughout. Several of them suffered from bacterial rot during the early summer, and eventually died. On August 3rd a plant was found which showed lesions resembling those of dry rot, and on incubation pycnidia and conidia typical of *Phoma Lingam* developed. Later, four other plants developed symptoms of dry rot, on three of which typical pycnidia were eventually produced. All these plants were attacked young, in most cases being rotted across at ground level, so that the roots never enlarged and they died prematurely. The plants in the control plot were more uniform and much better developed. No dry rot, or other disease, developed in them during the growing season, and when pulled up on November 30th, all the roots were quite sound.[1]

Although this experiment was conducted on a small scale it shows clearly enough that the disease survived in the soil of the contaminated plot at least from December until the following summer. This work is now being extended and repeated.[2] Whitehead and Jones,[3] working in Wales, believe that the initial outbreaks of dry rot are largely due to infective material in the manure.

The Distribution of Dry Rot in the Irish Free State, and the Factors affecting its Development.

Field observations and experiments looking to the control of dry rot were begun in 1926. The disease, which is of annual occurrence, was rather more severe than usual in that year, and complaints regarding it were general. A questionnaire addressed to thirty-five Instructors in Agriculture in the autumn showed that the disease was present in 25 of the 26 Counties of the Irish Free State, no particulars for Co. Louth being available. An attack of greater severity than usual was confirmed in most counties as a consequence, but the disease was not uniformly distributed, as will be seen from Fig. 1. The percentage of fields affected varied from less than 1 per cent. to about 100 per cent., the average being 38 per cent.; and the intensity of the attack in individual fields varied from a trace to nearly 50 per cent., the average being 10 per cent.

Almost all reporters agreed that swedes were more susceptible than turnips, and that the disease occurred on all soils. The remaining information secured was indefinite or conflicting. A number of observers considered heavy manuring, or farmyard manure, a contributory factor, while nitrogen, sulphate of ammonia, basic slag, superphosphate, lime, and absence of potash were blamed in individual cases. The majority believed

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1 The details of this experiment were carried out by Mr. R. McKay.

2 Exactly similar results have been secured in 1929 since this paper was written.

3 Whitehead, T. and W. A. P. Jones. "Dry-rot" of Swedes. Welsh Journ. of Agric. V.: 159–175, 1929.

that early sowing resulted in a diseased crop. Some considered that drought favoured the disease, and others the reverse; while practically all agreed that the rotation was not a factor, probably because an interval of at least four years almost always intervenes between two swede crops.

On the important question of the susceptibility of varieties, there was almost complete absence of agreement. Taking the following well-known varieties of swede turnips, which are in general cultivation in the Irish Free State, Incomparable Green Top, Magnum Bonum, Caledonian, Tipperary, Up-to-Date, Best-of-All, and Magnificent, some observers classed each of them as showing resistance, while on the other hand some classed each as being susceptible.[1] So far as there was any approach to general agreement, the evidence appeared to indicate that Incomparable Green Top generally showed little dry rot, and Magnificent a good deal. It was also agreed that all varieties were liable to attack in bad years, indicating that immunity is not to be expected among the varieties in general use in Ireland.

In addition, data were secured in the same year by personal inspection and report of the amount of disease appearing in variety experiments in several parts of the country. There was here also an entire lack of agreement, and the results were sometimes directly opposed to those recorded in the last paragraph. Thus in one experiment, Incomparable was the worst of the eight varieties included, while Magnificent showed only half as much disease. In another experiment Magnificent was the most seriously affected of six varieties, and Incomparable showed less disease.

The most likely explanation of these conflicting results was considered to lie in one or both of the following directions:—

(1) Either varieties of swede turnips are not true to name; or

(2) The different amounts of disease which appear in a number of varieties grown together do not represent individual susceptibilities, but depend on varying amounts of initial infection, whether in the seed, manure or soil.

Experiments concerning the Origin of Dry Rot Infection in the Field (1927).

Accordingly in the following year experiments were undertaken to throw light on these two points. The Department of Agricultural Botany of the College[2] sowed 110 small lots of swede turnips, including duplicate lots from different sources of some of the best-known varieties. The result was, as anticipated, that different lots under the same name had frequently quite different appearances, and even in the same lot there were not infrequently plants of distinct types. These features were more marked in the case of some of the older varieties.

To secure preliminary information on the question of seed infection it was decided, with the approval of the Department of Agriculture, to sow uniform seed of 12 varieties, each lot of seed being secured from the same

[1] As will be seen, exactly similar results were secured in the experimental work recorded below.

[2] We are indebted to Mr. M. J. Gorman for permission to use these results.

source; and in almost every case from the original introducer of the variety (in one case the introducer was unknown), at the Agricultural Stations at Athenry, Co. Galway, and at Clonakilty, Co. Cork. The assumption underlying this experiment was that if any lots of seed were infected, the resulting crops should show approximately corresponding amounts of disease at both centres, assuming that other sources of infection were either absent or so distributed as to affect all varieties equally.

The areas sown with each variety were approximately 0·65 and 0·5 acres at Athenry and Clonakilty, respectively, each plot being 12 drills wide and 340 yards long in the former case, and 160 yards in the latter. Owing to unavoidable circumstances, each variety at Clonakilty had to be sown in two separate plots, one containing eight drills and the other four. The plots were dressed with farmyard manure, care being taken to see that this was uniform and not contaminated with the refuse from turnip heaps or diseased roots. In addition to the farmyard manure an application of 6 cwt. " Semsol " per acre was made. A width of at least 20 drills intervened on each side between the experimental area and the boundary of the field.

The following table shows the results of these experiments. The crops were personally inspected in November, and the estimates then made of the amount of disease present agreed closely with those found when the crop was pulled.

FIELD EXPERIMENTS IN 1927.

Variety.	Percentage of Dry Rot in Field at:—		Remarks.
	Athenry, Co. Galway.	Clonakilty, Co. Cork.	
Acquisition ...	3·1	5·6	Uniformly low to moderate percentages of infection at both Stations.
New Buffalo ...	3·5	6·9	
Tipperary ...	5·0	5·3	
Lord Edward ...	5·3	3·9	
Caledonian ...	5·7	10·2	
Best-of-All ...	6·1	9·0	
Keepwell ...	7·0	8·5	
Magnum Bonum ...	3·2	15·2	Low percentages at Athenry, high at Clonakilty.
Kinaldie ...	3·3	14·0	
Up-to-Date ...	6·5	13·6	
Magnificent ...	18·7	17·1	High percentages at both Stations.
Incomparable ...	19·8	12·2	

The interpretation of these results is believed to be as follows:—The first seven varieties reacted reasonably uniformly at both Stations, due to minimal amount of initial infection. The same may be said of the last two, in which however the infection was severe, due presumably to seed infection. The other three varieties, Magnum Bonum, Kinaldie and Up-to-

Date are peculiar, in that they showed little disease at Athenry but much at Clonakilty. In the latter place it was noticed already in November in the case of Magnum Bonum and Up-to-Date (which were adjoining) that the disease developed seriously at one end of the field, but practically not at all at the other. The case was possibly similar with Kinaldie. It may be concluded with reasonable safety, therefore, that a second factor operated at Clonakilty in the case of two at least of these varieties. This is presumed to be infection originating from old diseased roots, contained in manure or soil, for the adjoining plots all happened to contain fewer diseased plants than the three varieties in question.

Attempt to co-relate Outbreaks of Dry Rot in the Field with Seed Infection (1928).

Further laboratory help having become available, it was decided to repeat the field experiments as conducted in 1927 at Athenry and Clonakilty, and at the same time to examine all the seed mycologically, with a view, if possible, to connect outbreaks of disease with seed infection. We are again indebted to the Department of Agriculture, and to the Superintendents of the Agricultural Stations for their co-operation.

The field experiments were planned on the same lines as before, but only six well-known varieties were used. The seed in each case was procured from the original introducer in one lot, and was then thoroughly mixed and sampled by us before distribution to the Stations. This precaution was taken to prevent any possible difference in origin or degree of contamination of the seed.

The area sown with each of the six varieties was approximately one-half acre at each Station, each plot being 20 drills wide at Athenry and 12 dirlls wide at Clonakilty. The remaining details were practically as in 1927. In addition, a very small area was sown with the same seed at Glasnevin, Dublin, for observation purposes.

Mycological examination was carried out during the season following the method already described (p. 31). Owing to pressure of work it was found that all the varieties could not be adequately examined, and particular attention was, therefore, concentrated on three of them. The results are shown in the following table:—

SEED EXAMINATION AND FIELD EXPERIMENTS IN 1928.

—	No. of Seeds—		Percentage of Dry Rot in Field at—		
	Examined.	Showing *P. lingam*.	Athenry, Co. Galway (½ acre plots).	Clonakilty, Co. Cork (½ acre plots).	Glasnevin, Dublin (Small plots).
Caledonian ...	4,650	1	13·8	51·6	58·0
Tipperary ...	5.100	0	8·3	15·6	16·5
Up-to-Date ...	5,300	0	4·0	12·0	3·3
Best-of-All ...	500	0	4·3	17·5	9·0
Incomparable ...	500	0	1·0	12·6	4·4
Magnificent ...	500	0	3·7	7·8	3·8

It will be seen that the variety Caledonian was in this year much the most severely diseased at all three centres. This was already obvious in the latter part of August and in early September, for when the two principal experiments were visited at that time many infection centres, involving in some cases up to 40 roots, were already present in this variety, while in the others only a few small centres, involving 6 roots, or less, were found. A similar condition was observable throughout the latter part of the season at Glasnevin. The remaining varieties showed much less disease, and allowing for experimental errors, which in work of this kind may be of considerable magnitude, there is considerable uniformity in the *relative percentages* of disease shown at the three centres. The fact that the amounts of disease which developed at Athenry was lower than at the other Stations is probably due to climatic conditions. On the other hand, at Glasnevin where dry rot has not up to the present been found serious, a much larger amount of disease than usual developed not only in this experiment but in another crop raised from different seed.

It appears to be probable, therefore, that if a number of varieties are sown in different localities *under similar conditions*, as in this experiment, the relative amounts of disease they develop remains approximately constant. This is an important fact if it can be further established, and confirmation of it is being sought in 1929. It has already been shown, however, that the order in which the varieties stand may be changed by other factors, such as the occurrence of infective material in manure or soil.

The fact that there seems to be fair agreement in the relative amounts of disease shown by each variety in the three experiments must be explained either by—(1) varying amounts of seed infection; (2) varying susceptibility; or (3) both factors. The chances are remote that infection arising from other sources, such as manure or soil, could have varied as between one variety and another in the three experiments in the same way.

Caledonian was the only variety in which infection of the seed was found, and, as has been seen, it showed by far the most disease in the field. The difficulty, however, of referring all the disease to seed infection in this case is considerable. If one seed in 4,650 represents the initial infection, this would correspond to one infected seed in every 46½ yards of the average drill. If it be assumed for the sake of argument that each of these seeds gives rise to a diseased plant, this would correspond to about 137 initially infected plants per acre. After the operation of " thinning " or " singling " is carried out, only about 4 *per cent.* of the possible total number of plants survive. Unless the disease spreads before this time, therefore, the chances of survival of most of the affected plants are small. Even if we assume, as appears to be necessary, that the parasite spreads to such an extent before the plants are " thinned " that most of the original infection centres persist, the difficulty is still considerable. Disease originating from not more than 137 centres per acre must then spread to about half the crop. It is characteristic of dry rot that the infection progresses for the most part slowly and continuously, not discontinuously as in the case of many

other diseases, so that the centres of infection remain localised for the most part, particularly in the earlier portion of the season, and they do not begin to become obvious under Irish conditions until August.

Cunningham (*l.c.*) finds that one infected seed in one thousand, "or less," may lead to the total destruction of the crop in New Zealand in a bad year. The question whether one infected seed in 4,650 can lead to all the disease which developed in Caledonian is one which we cannot answer positively in the affirmative. That this amount of infection, small as it is, was in part, at least, responsible appears very likely.

The alternative explanation of the great amount of disease which developed in Caledonian is that this variety is more susceptible to attack than the others. There are, however, serious difficulties in accepting this view.

Field observations at Clonakilty in September offered some proof that Caledonian is rather susceptible as compared with Best-of-All, which was beside it. It was noticed in several places that where infection centres in Caledonian abutted on the Best-of-All plot, the disease had not yet spread into the latter.

A laboratory experiment carried out under controlled conditions also appeared to confirm this result. The experiment, however, was on a small scale, and the almost universal occurrence of infection on the roots late in the season prevented its repetition. A further test would be desirable before definite conclusions can be drawn.

If, as might be argued, there are indications that Caledonian showed more susceptibility in 1928 than the other five varieties, one would naturally anticipate that the same relative susceptibility should be shown by plants derived from seed sold under the same name and obtained from the original introducer in two consecutive years. Under these circumstances, no change in the genetical or physiological characters of the variety would be expected. Judged, however, by the standing of Caledonian in 1927, when it was compared with the same five varieties, among others (see table on p. 36), one would not have considered its susceptibility greater than the average.

The facts which have been thus brought to light may now be summarized. The most rational explanation of the outstanding amount of dry rot shown by Caledonian in 1928 is probably to be attributed in the first place to seed infection of extraordinarily small proportions, coupled perhaps with a greater susceptibility to infection than the other varieties in the experiment showed. It is not possible at present to apportion the relative importance of these two factors; but it may be presumed that in the absence of infection from the seed or other immediately adjacent sources, the factor of susceptibility would not be likely to come into play, when results such as those secured in 1927 might be expected.

If further work confirms the fact that seed infection of such minute proportions as 1 in 4,650 can have such a serious effect on the health of the crop, it will be necessary to examine a very large number of seeds to ensure a reasonable margin of safety.

SUMMARY.

Phoma Lingam occurs on the seeds of swede turnips (*Brassica Rutabaga* L.) of English origin. The maximum percentage of infected seeds found up to the present is 0·2. Species of *Macrosporium*, *Alternaria* and other fungi, which are not connected with dry rot, generally occur more abundantly on the seed.

Phoma Lingam as isolated from the seed, as well as from the leaf, of swede turnips is identical with the fungus isolated from specimens showing typical dry rot, and is capable of setting up dry rot in the roots.

The fungus principally responsible for dry rot in Ireland is identical with the fungus which fills a similar rôle in New Zealand.

The dry rot fungus is capable of persisting throughout the winter on the remains of diseased roots in the soil, and has been proved to convey infection from this source to the new crop in the following year.

The distribution of the disease in the Irish Free State is outlined, and the factors to which its occurrence has been attributed are discussed..

Data derived from field experiments in 1927 show that when twelve varieties, each of which came from the same source, were sown at two widely distant Stations, approximately corresponding amounts of dry rot developed in nine of them, while in three much more disease developed in one place than the other. This is interpreted to mean that the amount of disease which developed in the first nine varieties probably reflects the amount of infection they carried with them (*i.e.*, seed infection); while observations are recorded indicating that infection from other sources, such as manure or soil, played a part in at least two of the remaining varieties at one Station.

Similar field experiments were controlled in 1928 by a mycological examination of the seed. Seed of six of the varieties used in 1927, from the same source in each case (the sources being also the same as in 1927), were sown in three widely separated places. A trace of *P. Lingam* (1 infected seed in 4,650) was found on one variety only, and this variety developed the greatest amount of disease in each of the three experiments.

The difficulty of referring the great excess of disease which developed in one variety in 1928 to the minimal amount of seed infection found is discussed, but there are difficulties at least as great in referring it to greater susceptibility, although this may have been a contributory factor. On the whole, it must on the evidence be concluded that seed infection was mainly responsible.

It has been shown that varieties of swede turnip procured under the same name from different sources are sometimes distinct. This might lead to an apparently different reaction of the same variety to the disease. Even when a number of varieties are procured from the same source in each case (the original introducer) in consecutive years, there is no correspondence in the relative amounts of dry rot shown in the two seasons. Assuming in the latter case that no genetical change has taken place, the facts are most easily explained by reference to varying amounts of seed infection.

REPORT ON THE WORK OF THE SEED PROPAGATION DIVISION FOR 1928.

On the establishment of a Faculty of Agriculture in University College, Dublin, and the consequent transfer thereto of the Albert Agricultural College, Glasnevin, arrangements were made whereby the propagation of parent stocks of oats and wheat previously introduced and grown under the supervision of the Department's Seed Propagation Division would be continued at the Albert Agricultural College, Glasnevin. Parent stocks of barley continue to be grown at the Department's Cereal Station at Ballinacurra, County Cork, and, in addition, extension work with oats, barley and wheat on the lines of that conducted in previous years was continued under the Department's control. Particulars of the work conducted under the Department's supervision during the season of 1928 are embodied in this report and an account of the work carried out at the Albert Agricultural College, Glasnevin, will be found in the Department's Annual Report.

Weather Conditions in 1928.

The rainfall for January, 1928, was the highest yet recorded for that month at the Cereal Station, Ballinacurra, Co. Cork. Rain fell on almost every day during the month. The wet weather continued up to the middle of February when a dry spell set in. During the months of March and April the rainfall was again abnormally heavy, being about double the average for this period. The weather during May and June was harsh and cold and generally unfavourable to growth. Conditions, however, improved during the month of July and throughout this period growth was rapid. The rainfall in August was again high and the temperature was low throughout the month with the result that conditions generally were unfavourable to the proper development and ripening of cereals. Weather conditions improved towards the beginning of September, and the harvesting of corn crops, though delayed, was carried out under favourable conditions.

In spite of the unfavourable Spring season there was no failure in any of the cereal cultivations or experiments conducted at Ballinacurra and other centres, and all crops were harvested in good condition, although both the yield and appearance of the grain were indicative of the unfavourable growing season.

BARLEY.

I.—PROPAGATIONS.

The seed for all the pedigree cultivations grown at the Cereal Station, Ballinacurra, County Cork, during 1927, was treated with Formalin solution

and the resulting crops were comparatively free from smutted plants. Owing, however, to the amount of smut present in the district and in adjacent crops grown from seed which had not been treated with formalin it was again considered advisable to take precautions against the occurrence of smut and, accordingly, all seed for propagations and experiments in 1928 was treated before sowing.

In the experiments on the prevention of smut in barley conducted for some years past at the Cereal Station, Ballinacurra, it was found that the dressing of Abavit Powder proved effective in controlling smut and, as the adoption of this treatment presents less difficulty than the use of formalin or other liquid dressings, all seed was treated with Abavit powder before sowing. The result was most satisfactory, not a single smutted plant being found in any of the crops grown from the treated seed, and on examining the grain in the laboratory it was found to be practically free from smut spores.

(i.) *Pure Line Propagation and Hybrids.*

(*a*) In the cereal cages at Ballinacurra seventy-five single plant selections comprising all the well known varieties in general cultivation, together with a number of hybrids and selections from old native stocks, were grown.

(*b*) Twenty-nine garden plots seeded with various selections were also grown at Ballinacurra in the Rosehill South Paddock.

(*c*) Fifteen field plots were sown with varieties required for further propagation and large scale experiments.

(ii.) 1*st Pedigree Propagations.*

Plots of Spratt-Archer 37 No. 3, Spratt-Archer 37 No. 4, Archer-Goldthorpe-Spratt 3/3/3 and Abed Rex X Spratt-Archer 37/18 were grown on the farm of Mrs. O'Brien, Loughatalia, Ballinacurra, and plots of Spratt-Archer 37/6 and Spratt-Archer 37/17/52 were grown on the farm of Mr. C. Deasy, Loughatalia.

(iii.) 2*nd Pedigree Propagations.*

A plot of Spratt-Archer 37 No. 3 was grown on the farm of Mr. C. Deasy, Loughatalia, Ballinacurra.

Plots of Spratt-Archer 37 No. 4 were grown on the following farms :—

		acres.
C. Deasy, Loughatalia, Ballinacurra, Co. Cork	...	2
M. Kelleher, Geragh, Ballinacurra, Co. Cork	...	10
T. Wall, Ballinatowtas, Midleton, Co. Cork	...	14
J. Leahy, Innegrega, Midleton, Co. Cork	...	5
Wm. McAuliffe, Carrigatogher, Midleton, Co. Cork	...	8
J. Treacy, Carrigatogher, Midleton, Co. Cork	...	5
Total ...	...	44

(iv.) *Inspection of Growing Crops.*

The Department again arranged for the inspection of growing crops with a view to determining the probable suitability of the produce for seed purposes in the following season. The inspections were confined to crops of Spratt-Archer barley grown (*a*) from seed distributed from Ballinacurra in 1928; (*b*) from seed the produce of seed sent out from Ballinacurra in 1927 and; (*c*) from commercial Spratt-Archer seed.

An area of, approximately, 4,852 acres of barley was inspected, 3,209 acres of this area being reported as likely to produce grain suitable for seed purposes. The crops on the remaining 1,643 acres were rejected for seed purposes for several reasons. Smut was present in 1,323 acres; the grain was of inferior quality on 121 acres; an undue proportion of noxious weeds was present in 211 acres, and 145 acres were grown in fields on which more than one variety was sown. Of the 759 acres inspected under (*a*) above, only 10 per cent. were rejected for seed purposes, and of the 1,310 acres inspected under (*b*) 12 per cent. were rejected, while of the 2,783 acres grown from commercial seed 47 per cent. were rejected as likely to be unsuitable for seed purposes.

II.—Large Scale Variety Experiments.

These were conducted at ten centres :—Four in Co. Wexford, and one each in Offaly, Louth, Kildare, Laoighis, North Tipperary and Cork. Spratt-Archer 37/6, Spratt-Archer 37 No. 3, Spratt-Archer 37 No. 4, and Spratt-Archer 37/17/52 were included at all centres. In addition Old Irish was included at two centres in Co. Wexford and July six-rowed was grown at two centres, one in Co. Wexford and the other in Co. Kildare. The area of the individual plots at each centre was one statute acre. All plots were sown with pedigree seed supplied from the Department's cereal station at Ballinacurra. In Table I. are set out the names and addresses of the plotholders, the previous years' cropping, together with the nature of the soil, and the dates of sowing and harvesting. In Table II. are shown the yield of dressed grain, the value per barrel of the grain, and the total value of the grain including screenings per statute acre.

Spratt-Archer 37 No. 4, which in the previous season's trials gave the best return, proved inferior both as regards yield and quality of the grain to the other three elections of Spratt-Archer which gave practically similar returns. Spratt-Archer 37/17/52 again produced grain of a quality superior to that of the other varieties included in the experiment.

At one of the centres in Co. Wexford where Old Irish was included in the experiment and where the soil was light and sandy this variety gave the heaviest yield of grain. The quality of the grain, however, was inferior to that produced by the other varieties. At the other centre where the soil was of a rather stiff and heavy character Old Irish proved inferior in yielding capacity to the Spratt-Archer varieties. The grain, however, was only surpassed in quality by that of Spratt-Archer 37/17/52.

July six-rowed which was included for the first time in these experiments last year was grown at two centres, one in Co. Kildare and the other at Curracloe, Co. Wexford. At the former centre the soil was a good deep loam and at the latter it was light and sandy. At each centre this variety grew vigorously and developed more rapidly than the Spratt-Archer varieties and was ready for harvesting nearly three weeks before these varieties were fit for cutting. In yielding capacity and also in quality of grain, particularly on the heavier type of soil, July six-rowed, however, compared unfavourably with the Spratt-Archer types.

TABLE I.

Large Scale Variety Experiments, 1928.

Centre	Name and Address of Grower.	Description of Soil.	Previous Crops.	Date of Sowing.	Date of Harvesting
1	Mrs. Tait, Hermitage, Rostellan, Co. Cork.	Loam ... Sub-soil Shale	Oats, '26 Mangolds, '27	April 7th	August 30th
2	Wm. Watkins, Coolnagrower, Birr, Offaly.	Light Loam ... Sub-soil Gravel	Oats, '26 Roots, '27	April 16th	Sept. 8th-11th
3	H. Burke, Kilmacoe Lodge, Curracloe, Wexford.	Sandy Loam ... Sub-soil Gravel	Barley, '26 Beet, 27	April 25th	Aug. 14th Sept. 6th & 7th
4	W. J. Waller, Prior Park, Nenagh, Co. Tipperary.	Light Loam ... Sub-soil Gravel	Oats, '26 Beet, '27	April 17th	Sept. 7th & 10th
5	H. O'Reilly, Clonmore, Dunleer, Co. Louth.	Stiff Loam ... Sub-soil Gravel	Oats, '26 Roots, '27	April 23rd	Sept. 14th & 15th
6	N. Howlett, Ramsgrange, Co. Wexford.	Stiff Loam ... Sub-soil Shale	Oats, '26 Roots, '27	April 19th	Sept. 2nd & 9th
7	M. P. Minch, Rockfield, Athy, Co. Kildare.	Deep Loam ... Sub-soil Gravel	Barley, '26 Roots, '27	April 6th	Aug. 14th & 31st Sept. 1st
8	P. Byrne, Ballygrangans, Kilmore, Co. Wexford.	Sandy Loam ... Sub-soil Gravel	Oats, '26 Turnips, '27	April 20th	Sept. 6th & 7th
9	D. Morris, Tomahurra, Enniscorthy, Co. Wexford	Shale Loam ... Sub-soil Shale	Oats, '26 Roots, '27	April 13th	Sept. 3rd & 4th
10	A. E. Smyth, Raheen, Donaghmore, Leix.	Stiff Loam ... Sub-soil Limestone.	Oats, '26 Roots, '27	April 18th	Sept. 10th & 11th

III.—Small Scale Quantitative Experiment.

An experiment with eight varieties was conducted in the New Cereal Cage at Ballinacurra last season. The plots were sown on the chessboard system, the arrangement being five plots abreast in twenty-four consecutive lines, divided into three series ; the middle series being sown in the reverse order of the two end series. This arrangement was adopted in order to get the greatest possible number of random positions for each variety. As the soil in the cage was rather rich the crops grew rankly and lodged slightly. The weather, however, favoured harvesting operations which were completed without undue loss. A summary of the yields obtained from the different varieties is shown in Table III.

TABLE III.

Small Scale Quantitative Experiments, Ballinacurra, 1928.

	Total Yield of Grain in Grammes	Yields compared on the basis of D.S.K. as 100
Spratt-Archer 37/6	4289·54	95·5
Archer	4192·86	93·4
D.S.K.	4490·12	100·0
Abed Prentice	4169·80	92·9
S.A. 37/18 x G.S. 18/1 1/1	4085·25	91·0
Spratt-Archer 37/12/41	4418·96	98·4
G.S. 18/1 x G.S. 1/4 3	3980·68	88·7
Abed Rex x S.A. 37/18 6/1	4243·96	94·5

In malting trials conducted with the produce of the plots D.S.K. proved definitely superior to all the other varieties. Abed Rex x Spratt-Archer 37/18 6/1, Spratt-Archer 37/12/41, and G.S. 18/1 x G.S. 1/4 3 gave somewhat similar returns in the malting tests and while inferior to D.S.K. were superior to the other four varieties. Combining the results from the growing and malting trials the relative values of the varieties taking D.S.K. as the standard at 100 are shown in the Table IIIa.

TABLE IIIa.

D.S.K.	100
Spratt-Archer 37/12/41	97
Spratt-Archer 37/6	$93\frac{1}{2}$
Abed Rex x Spratt-Archer 37/18 6/1	$93\frac{1}{2}$
Archer	$91\frac{1}{2}$
Abed Prentice	$90\frac{1}{2}$
S.A. 37/18 x G.S. 18/1 1/1	89
G.S. 18/1 x G.S. 1/4 3	85

TABLE II.

LARGE SCALE BARLEY VARIETY EXPERIMENTS, 1928.

Yield and Value of Grain per Statute Acre.

Centre.	Spratt-Archer 37/6.			Spratt-Archer 37 No. 3.			Spratt-Archer 37 No. 4.			Spratt-Archer 37/17/52.			Old Irish.			July Six-rowed.		
	Yield of Dressed Grain.	Value per Barrel.	Total Value,* including Screenings.	Yield of Dressed Grain.	Value per Barrel.	Total Value,* including Screenings.	Yield of Dressed Grain.	Value per Barrel.	Total Value,* including Screenings.	Yield of Dressed Grain.	Value per Barrel.	Total Value,* including Screenings.	Yield of Dressed Grain.	Value per Barrel.	Total Value,* including Screenings.	Yield of Dressed Grain.	Value per Barrel.	Total Value,* including Screenings.
	brls. sts.	@	£ s. d.	brls. sts.	@	£ s. d.	brls. sts.	@	£ s. d.	brls. sts.	@	£ s. d.	brls. sts.	@	£ s. d.	brls. sts.	@	£ s. d.
Cork.																		
Mrs. Tait	8 8	15/–	6 13 2	7 14	15/–	6 4 1	8 6	15/–	6 11 3	8 6	15/3	6 13 0	—	—	—	—	—	—
Offaly.																		
Wm. Watkins ...	9 1	16/–	7 7 8	9 4	16/–	7 11 8	8 2	15/9	6 10 3	8 15	16/–	7 7 8	—	—	—	—	—	—
Laoighis.																		
A. Smyth	10 3	15/6	8 3 11	10 10	15/9	8 13 4	10 0	15/9	8 2 10	9 14	15/9	8 1 6	—	—	—	—	—	...
Tipperary.																		
W. Waller	10 1	15/3	8 0 9	11 4	15/6	9 2 0	10 6	15/3	8 5 6	11 2	15/9	9 2 2	—	—	—	—	—	—
Kildare.																		
M. P. Minch	13 14	15/9	11 2 2	13 13	15/9	11 1 6	12 8	15/9	10 0 2	13 9	16/–	11 0 6	—	—	—	11 6	14/6	8 12 11
Louth.																		
H. O'Reilly	14 6	15/6	11 10 9	15 1	15/6	11 18 9	13 8	15/6	10 13 11	14 3	15/6	11 8 3	—	—	—	—	—	—
Wexford.																		
P. Byrne	12 1	14/6	9 1 7	11 12	14/3	8 12 1	10 15	14/6	8 3 11	11 3	14/6	8 5 10	—	—	—	—	—	—
N. Howlett	10 0	14/9	7 12 2	10 12	14/9	8 2 2	9 2	14/9	6 17 11	9 12	15/–	7 9 7	9 0	14/9	6 16 9	—	—	—
H. Burke	8 14	15/–	7 3 9	7 12	15/3	6 8 10	7 3	15/3	6 0 3	8 12	15/3	7 4 1	10 2	14/6	7 17 6	7 12	15/–	6 9 7
D. Morris	11 15	15/3	9 4 5	11 1	15/6	8 13 9	10 3	15/3	7 18 10	11 8	15/6	9 0 11	—	—	—	—	—	—
Total at 10 centres ...	108 15	—	86 0 4	109 3	—	86 8 2	100 5	—	79 4 10	107 4	—	85 13 6	—	—	—	—	—	—
Average at 10 centres ...	10 14	—	8 12 0	10 15	—	8 12 10	10 0	—	7 18 6	10 12	—	8 11 4	—	—	—	—	—	—
Total at 2 centres where Old Irish was grown ...	18 14	—	14 15 11	18 8	—	14 11 0	16 5	—	12 18 2	18 8	—	14 13 8	19 2	—	14 14 3	—	—	—
Average ditto	9 7	—	7 7 11	9 4	—	7 5 6	*8 2	—	6 9 1	9 4	—	7 6 10	9 9	—	7 7 1	—	—	—
Total at 2 centres where July six-rowed was grown ...	22 18	—	18 5 11	21 9	—	17 10 4	19 11	—	16 0 5	22 5	—	18 4 7	—	—	—	19 2	—	15 2 6
Average ditto	11 6	—	9 2 11	10 12	—	8 15 2	9 13	—	8 0 2	11 2	—	9 2 3	—	—	—	9 9	—	7 11 3

* Screenings valued at 8*d.* per stone.

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Archer	91½
Abed Prentice	90½
S.A. 37/18 x G.S. 18/1 1/1	89
G.S. 18/1 x G.S. 1/4 3	85

IV.—Half Drill Strip Experiments, 1928.

Two experiments were again conducted at the Ballinacurra Cereal Station on exactly the same lines as in previous years.

In No. 1 experiment Spratt-Archer 37/6 and Abed Rex Spratt-Archer 37/18 1/1 were grown, while in No. 2 experiment Spratt-Archer 37 No. 3 and Spratt-Archer 37 No. 4 were compared.

The total area under each experiment was approximately one and one-twelfth statute acres.

The results of both experiments are shown in Table IV., where the yields of dressed grain from the contiguous half drill strips are shown opposite to each other.

These results show that in No. 1 experiment, Spratt-Archer 37/6 was significantly better than Abed Rex x Spratt-Archer 37/18 1/1 in point of yield. The results of malting tests conducted with the produce indicated that both varieties were equally valuable for malting. In the No. 2 experiment the returns show that as regards yield there is no significant difference between Spratt-Archer 37 No. 3 and Spratt-Archer 37 No. 4.

As a result of moisture determinations of the grain made at harvest time, it would appear that Spratt-Archer 37 No. 4 tends to ripen earlier than Spratt-Archer 37 No. 3, and Spratt-Archer 37/6 earlier than Abed Rex x Spratt-Archer 37/18 1/1.

TABLE IV.

Half Drill Strip Experiment No. 1. Half Drill Strip Experiment No. 2.

Strip	S.A. 37/6			Strip	A.R. x S.A. 1/1			Strip	S.A. 37 No. 3			Strip	S.A. 37 No. 4		
	st.	lbs.	ozs.		st.	lbs.	ozs.		st.	lbs.	ozs.		st.	lbs.	ozs.
a	2	11	4	B	2	0	4	a	3	1	4	B	3	1	8
C	3	0	0	b	2	8	12	C	3	2	4	b	2	13	8
c	2	6	12	D	2	3	12	c	2	8	8	D	3	2	8
E	2	9	4	d	2	3	4	E	3	1	4	d	2	4	12
e	3	0	4	F	2	7	0	e	3	0	0	F	2	9	4
G	2	10	0	f	2	4	8	G	2	13	12	f	2	12	12
g	2	8	0	H	2	6	12	g	3	0	8	H	2	13	4
I	3	0	4	h	2	4	8	I	3	0	0	h	2	8	8
i	2	7	8	J	2	7	4	i	2	11	12	J	2	12	0
K	3	2	12	j	2	0	0	K	3	0	4	j	2	12	12
k	2	10	4	L	2	10	12	k	3	0	4	L	2	10	4
M	3	1	4	l	2	3	4	M	2	13	4	l	2	13	4
m	2	9	4	N	2	7	12	m	2	5	8	N	2	12	12
P	2	12	4	n	2	2	12	P	3	0	4	n	2	11	12
p	2	10	12	Q	2	10	0	p	2	13	12	Q	2	12	12
R	3	0	12	q	2	0	0	R	3	0	0	q	3	0	4
r	2	6	4	S	2	9	12	r	2	7	12	S	2	12	12
T	2	13	0	s	2	0	0	T	2	12	0	s	2	10	12
t	2	10	4	V	2	13	4	t	2	12	8	V	2	9	12
W	2	13	8	v	2	9	8	W	2	9	12	v	2	8	8
w	2	10	4	X	2	12	8	w	2	8	12	X	2	6	12
Y	3	0	0	x	2	3	12	Y	2	4	0	x	2	8	0
Total	61	13	12	Total	53	3	4	Total	63	1	4	Total	61	12	4
Avrge.	2	10	15	Avrge.	2	5	14	Avrge.	2	12	2	Avrge.	2	11	6

V.—Experiment with Barley of the same stock but of varying nitrogen content.

This Experiment was conducted with a view to determining whether there is any relation between the composition of seed grain (especially in regard to its nitrogen content) and the yield and quality of its resultant produce.

With the object of producing seed for this experiment two plots of Spratt-Archer 37/6 were grown on the farm of Mrs. O'Brien, Ballinacurra in the season of 1927. One plot was treated with a heavy dressing of sulphate of ammonia while the other plot received no nitrogenous manure. The grain produced on the plot which had been dressed with sulphate of ammonia was, on analysis, found to contain 1·73 per cent. nitrogen calculated on the dry matter, while the nitrogen content of the grain from the corresponding plot which had not been dressed with an nitrogenous manure was 1·39 per cent. The produce of these two plots was grown in quantitative experimental plots at two centres last season, one at Ballinacurra, County Cork, and the other at Athy, County Kildare. The results from each centre and the average returns from both centres are shown in Table V.

TABLE V.

Name of Grower.	Half Statute Acre Plots.					
	Produce of High Nitrogen Seed.			Produce of Low Nitrogen Seed.		
	Yield of dressed grain.	Value per brl.	Value of dressed grain.	Yield of dressed grain.	Value per brl.	Value of dressed grain.
	brls. sts. lbs.	s.	£ s. d.	brls. sts. lbs.	s.	£ s. d.
M. P. Minch, Athy	6 10 5	16/–	5 6 5	6 12 11	16/–	5 9 0
Mrs. O'Brien, Ballinacurra ...	4 9 8	15/6	3 11 5	4 12 0	15/6	3 13 7
Total ...	11 3 13	—	8 17 10	11 8 11	—	9 2 7
Average ...	5 9 13	—	4 8 11	5 12 5	—	4 11 3

It will be observed that as regards quality of the grain, there was no difference in that produced by the seed of high nitrogen content and that of low nitrogen content. The difference in yield while in favour of the seed of low nitrogen content is not significant. The results of this experiment, therefore, indicate that the quality of the grain produced or the yield obtained is not necessarily influenced by the nitrogen content of the seed sown.

VI.—Experiments in the use of Formalin, Copper Carbonate Powder, Copper Carbonate and Mercuric Chloride, "Germisan" and "Abavit Powder" as Preventatives of Smut and Stripe Disease.

This experiment which was again conducted at Ballinacurra consisted of sixteen plots, each of approximately 1/17 of a statute acre in extent, arranged in two series of eight plots each.

The seed used in the experiments was highly infected with the spores of covered smut (Ustilago Hordei and the spores were in an active and virile condition.

The treatments were as follow:—

Nos. 1 and 9 ... Seed steeped in 1/240 Formaldehyde solution for 20 minutes, drained, covered for 4 hours and dried.

Nos. 2 and 10 ... Seed steeped in 1/320 Formaldehyde solution for 20 minutes, drained, covered for 4 hours and dried.

Nos. 3 and 11 ... Seed sprayed with equal parts of 40 per cent. Commercial Formalin and water, covered for 4 hours and dried.

Nos. 4 and 12 ... Seed steeped in Germisan 0·25 per cent. solution for 30 minutes, drained, and dried at once.

Nos. 5 and 13 ... Seed dusted with Copper Carbonate Powder.

Nos. 6 and 14 ... Seed dusted with Copper Carbonate and $Hg. Cl_2$. Powder.

Nos. 7 and 15 ... Seed dusted with "Abavit Powder" (200 grms. per cwt.).

Nos. 8 and 16 ... Ge-Ka-be treatment, *i.e.* seed sprinkled with 5·2 grms. of Germisan dissolved in 9 fluid ounces of water and revolved in a "Primus" machine for 5 minutes.

In Table VI. are set out the various treatments and the results of each on the prevention of smut and stripe disease, together with the yields of grain from each plot.

As in the previous year Abavit Powder again proved very effective in destroying smut, and it also appeared to be of value in preventing stripe disease. This treatment has the further advantage of being easily applied. The mixture of Copper Carbonate and Mercuric Chloride was also efficacious in the control of smut, but not of stripe disease. The Copper Carbonate powder used alone had little effect either on smut or stripe disease. The treatment with the stronger solution of Formalin (1/240) was slightly less effective than Abavit in controlling smut, and it was equally as useful in reducing stripe disease. This method of treatment is, however, tedious and moreover its effect on

germination is uncertain unless the greatest care is taken in carrying it out. The weaker solution of Formalin (1/320) which has now been tried for a number of years has been definitely proved to be less efficacious than the stronger solution.

TABLE VI.

TREATMENT FOR PREVENTION OF SMUT AND STRIPE DISEASE 1928.

Plot Nos.	Treatment.	Stripe Disease.	No. of smutted plants counted. Series. 1	2	Yield. Series. 1	2	Average
					sts. lbs.	sts. lbs.	sts. lbs.
1 & 9	Formalin 1/240 ...	Not prevalent	1	2	5 9	5 7	5 8
2 & 10	Formalin 1/320 ...	Not prevalent	3	14	5 4	5 9	5 6½
3 & 11	Formalin spray equal parts.	Prevalent ...	0	1	5 5	4 12	5 1½
4 & 12	Germisan	Not prevalent	3	3	6 2	5 10	5 13
5 & 13	Copper Carbonate ...	Very prevalent	10	18	5 11	5 10	5 10½
6 & 14	Copper Carbonate and Mercuric Chloride.	Prevalent ...	1	0	6 0	6 0	6 0
7 & 15	Abavit Powder ...	Not prevalent	0	0	5 12	5 7	5 9½
8 & 16	Ge-Ka-Be	Not prevalent	0	4	5 10	5 12	5 11

Note.—The first column of each pair refers in each case to the lower numbered plot.

Formalin and water (equal parts) applied as a spray proved quite effective against smut but exercised no control over stripe disease. Germisan again proved less satisfactory than it did in the earlier trials. Ge-Ka-Be, which is a preparation of Germisan, gave satisfactory results as regards control of both smut and stripe disease, but as it has only been tried in one season, further tests are necessary before it can be recommended for general use.

VII.—Barley Experiments in County Donegal.

In the area adjoining the northern sea-board of County Donegal a considerable area of barley is grown for local consumption. The varieties usually grown are old native two-rowed and six-rowed types which mature very quickly and can, therefore, be sown late in the season. In view of the fact that these varieties are very impure and that they do not yield well it was decided, last year, to conduct trials in County Donegal with a few of the better known varieties particularly those which ripen early in the season. Accordingly arrangements were made to have experiments conducted at four centres, two in the Carndonagh area and two in the Cresslough district.

Spratt-Archer 37/6 and July six-rowed were sown at all four centres and Old Irish of the type grown in Co. Wexford was also included at three of these centres. The seed of each variety was drawn from pure line stocks grown at Ballinacurra in the previous year. The plots at each centre were one-third of a statute acre in size.

The names of the plotholders, the nature of the soil, the dates of sowing and harvesting and yields per statute acre obtained at each centre are set out in Table VII.

TABLE VII.

Grower.	Nature of Soil.	Variety.	Date of Sowing.	Date of Harvesting.	Yield per Stat. acre. Grain	Yield per Stat. acre. Straw
					Stns.	Cwts.
Mr. Robert Moore, Churchtown, Carndonagh.	Dark sandy loam.	Spratt-Archer 37/6	16/4/28	1/9/28	145½	36
		Old Irish ...	,,	27/8/28	162	33
		July six-rowed ...	,,	23/8/28	154½	21½
Miss McCormack, Dunross, Cooldaff.	Sandy loam.	Spratt-Archer 37/6	17/4/28	3/9/28	168	—
		Old Irish ...	,,	29/8/28	189	—
		July six-rowed ...	,,	25/8/28	193½	—
Mr. Wm. McElhinney, Cloonemore, Cashelmore	Clay loam.	Spratt-Archer 37/6	16/4/28	5/9/28	108	—
		Old Irish ...	,,	30/8/28	183	—
		July six-rowed ...	,,	24/8/28	174	—
Mr. Hugh McGinley, Kilmacloo, Creeslough.	Clay loam.	Spratt-Archer 37/6	16/4/28	13/9/28	135	—
		July six-rowed ...	,,	30/8/28	139	—

Old Irish gave the highest yield at two out of the three centres where it was grown, and on the average was slightly better than July six-rowed. The latter variety, however, ripened earlier than Old Irish at each centre. Spratt-Archer 37/6 produced the lowest yield at each centre. The reduction in yield of Spratt-Archer 37/6 was perhaps mainly due to the fact that the grain was not fully matured at harvesting time, even though this variety was not cut for several days after the other varieties. As a result of these trials it is evident that the Spratt-Archer type of barley, owing to its slow maturing character, is not suitable for cultivation in the area adjoining the northern sea-board of County Donegal.

VIII.—Winter Sown Barley.

In order to test the suitability of July six-rowed barley as a Winter variety, an experiment was conducted at Ballinacurra last season. Three plots of a quarter acre each were laid out on a uniform piece of ground. One plot was seeded on the 16th September, the second on the 13th October and the third on the 7th April.

The September sown plot germinated quickly and grew well during the early Winter period. The crop, however, was slightly patchy but this patchiness may have been due to the depredations of wild birds. Although the weather throughout the Winter was comparatively mild, a considerable number of plants withered and died out during this period and when growth started in Spring, weeds developed rapidly with the result that the whole crop became more or less smothered out with weeds and eventually it was ploughed up.

The October sown crop did not develop so rapidly during the early Winter as the September sown crop and it did not appear to have suffered much damage as a result of Winter conditions. It developed normally during the Spring and Summer and ripened early in the season. However, it produced a relatively poor return and as regards both yield and quality of the grain it was distinctly inferior to the crop on the Spring sown plot.

In view of the results obtained in this trial, it is evident that the July Six-rowed variety is not suitable for sowing as a Winter barley even in southern districts.

WHEAT.

A large propagation plot of approximately 7 acres of Red Stettin wheat was grown on the farm of Mr. William Prendergast, Derrygrath, Cahir, Co. Tipperary, and County Extension Plots of the same variety, varying in size from 1¼ to 10 statute acres, were grown at the following centres :—

Mr. Patrick O'Connor, Nicholastown, Knocklofty, Clonmel, County Tipperary.
Rockwell College, Cashel, County Tipperary.
Mr. Edmond Shine, Garryroe, Ardfinan, Co. Tipperary.
Mr. John Murphy, Ballyneety, Ardfinan, County Tipperary.
Mr. Robert O'Shea, Cloran, Fethard, County Tipperary.
Mr. Michael Mockler, Redmondstown, Clonmel, County Tipperary.
Mr. J. W. Fahy, Mount Ruby, Mallow, County Cork.

The produce of the County Extension Plots was mainly sold for seed to farmers in the districts in which the plots were located. The bulk of the produce of the Department's Extension Plot grown on Mr. Prendergast's farm was utilised for the seeding of a further large sized Department's Extension Plot in South Tipperary, and for a number of County Extension Plots in Counties Tipperary, Cork and Kerry. In addition about seven barrels of this seed were employed in connection with the Small Scale Variety trials conducted by the Agricultural Instructors.

Small scale baking tests conducted with flour produced from this variety of wheat again showed that it is capable of producing loaves of good size and flavour and that, in this respect, it compares favourably with " Bakers' Flour." Red Stettin is a typically strong wheat and, therefore, more suitable for inclusion in a flour mixture for the production of bakers' bread than for the making of soda bread.

Extension plots of Coney Island (long straw) sown in Autumn and in Spring and similar plots of Coney Island (short straw) sown in Spring were arranged for at the Agricultural Station, Athenry. Extension plots of both varieties seeded in Spring were also sown at Clonakilty Agricultural Station. At the latter centre the seed sown germinated poorly and the crops had eventually to be ploughed up. At the Athenry centre, however, both the Autumn and Spring sown plots developed normally and satisfactory yields were obtained. The produce was utilised for the seeding of further extension plots and for the small scale variety trials conducted by the Agricultural Instructors.

OATS.

Propagations.

(a) Garden Plots.

Two garden plots of sandy Oats were grown at the Ballinacurra Cereal Station, one with seed obtained from The Albert Agricultural College, Glasnevin, the other with seed obtained from Aberdeen. Unfortunately both plots were badly attacked by wire worms, and the resulting crops were of little value.

(*b*) Small extension plots of Mansholt's III. and Abundance were also grown at Ballinacurra.

(c) Department's Oat Propagation Scheme.

The Department have had in operation for several years an Oat Propagation Scheme, under which comparatively large stocks of pedigree strains of the most prolific and valuable varieties of oats are distributed annually to selected farmers for the growing of County Extension Plots. Growers of these plots, which are selected by the Agricultural Instructors, are required to undertake that the crop will be cultivated and harvested under such conditions as to avoid possibility of admixture with other varieties; that the grain produce will, if suitable, be reserved for seed, and that the quantity not required for the grower's own seed requirements will be sold for seed purposes at a reasonable price to farmers in the vicinity in which the respective plots are situated.

As the land at the disposal of the Department at the Ballinacurra Cereal Station is limited, it has become necessary, in order that sufficient stocks of pedigree seed to meet the continually increasing demand for County Extension Plots may be provided, to grow large plots of pedigree oats on the lands of reliable farmers within easy reach of Ballinacurra Cereal Station. These plots are grown under the direct supervision of officers of the Seed Propagation Division who supervise sowing, cleaning and harvesting operations. After threshing, the produce of each plot is delivered immediately to the Ballinacurra Cereal Station where it is dried, re-cleaned and stored under the most favourable conditions. Oat plots grown at Ballinacurra under the conditions set out are known as Department's Extension Plots.

The Department's Extension Plots grown in the season of 1928 were as follows:—

Victory.—6 acres on the farm of Denis Mulcahy, Ballintubber, Carrigtwohill, Co. Cork.

Victory II.—15 acres on the farm of Cornelius Fitzgerald, Haymount, Carrigtwohill, Co. Cork.

Potato II.—5 acres on the farm of Thomas Twomey, Ballintubber, Carrigtwohill, Co. Cork.

Black Tartary.—6½ acres on the farm of James Deasy, Barry Court, Carrigtwohill, Co. Cork.

5½ acres on the farm of Cornelius Deasy, Ballinacurra, Midleton, Co. Cork.

(*d*) *County Extension Plots.*

In the following list the growers of County Extension Plots in the season 1928 the variety grown in each case, and the quantity of pedigree seed supplied are set out :—

Variety.	Name and Address of Grower.	Quantity of Seed Supplied.
		Stones
VICTORY ...	The Agricultural Station, Athenry, Co. Galway ...	70
" ...	Captain Whitehead, The Maltings, Birr ...	70
" ...	J. Bolger and Sons, Ferns, Co. Wexford ...	70
" ...	Rev. M. Kelly, St. Peter's College, Wexford ...	70
" ...	W. Hamilton, Bunson, Castlebar	14
" ...	T. Burke, Clogher, Westport, Co. Mayo ...	14
" ...	I. Fair, Clogher, Westport, Co. Mayo	14
" ...	E. Lenihan, Ballinahina, Whitechurch, Cork ...	32
" ...	M. Twomey, Kilblaufer, Berrings, Co. Cork ...	56
" ...	W. J. Cashman, Woodview, Glanmire, Cork ...	28
" ...	Mrs. D. Murphy, Grenagle, Blarney, Co. Cork ...	15
" ...	J. Brophy, Ballychair, Portlaoighise	42
" ...	R. Adams, Clonmore, Longford	28
" ...	P. Flood, Kilasonagh, Lismacaffrey	28
" ...	J. Gavigan, Granard, Floate	70
" ...	J. Carrighy, Robinstown, Granard	28
" ...	B. Masterson, Rencoola, Granard	42
" ...	C. J. McCarthy, Belead, Clonakilty, Co. Cork ...	16
" ...	J. W. Fahy, Mountruby, Mallow, Co. Cork ...	70
" ...	J. Twomey, Kilcor, Fermoy, Co. Cork	42
" ...	C. Reynolds, Granard, Floate	14
" ...	L. Kearney, Rencoola, Granard	14
" ...	P. Higgins, Abbeylara, Granard	14
" ...	L. Murphy, Togher House, Roundwood, Co. Wicklow	28
" ...	J. Doyle, Luckmill, Baltinglass, Co. Wicklow ...	21
" ...	W. Burke, Bridgehouse, Skibbereen, Co. Cork ...	20
" ...	John Allen, Cooltigue, Co. Roscommon ...	28
" ...	John Kersey, Kilmacthomas, Co Waterford ...	84
" ...	M. Galvin, Kiskeam, Newmarket, Co. Cork ...	4
" ...	T. Cronin, Castleredmond, Midleton	42
	Total	1,088
VICTORY II. ...	T. McNamara, Tobernea, Kilmallock, Co. Limerick	42
" ...	V. G. Hynes, Church St, Portlaoighise ...	70
" ...	P. McEntee, Lisbree, Cootehill, Co. Cavan ...	7
" ...	T. Foy, Lisboduff, Cootehill, Co. Cavan ...	14
" ...	Jas. Armstrong, Gartinardress, Co. Cavan ...	7
" ...	J. Beatty, Technical Schools, Cavan	28
" ...	G. Condon, Kilmurry, Fermoy, Co. Cork ...	28
" ...	P. O'Connell, Killumney, Co. Cork	14
" ...	E. Wall, Crookstown, Co. Cork	14
" ...	W. H. Frost, Glenbrook, Bandon	14
" ...	C. Duggan, Greenfield, Ballincollig, Co. Cork ...	14
" ...	J. Keohane, Ardfield, Clonakilty, Co. Cork ...	16
" ...	B. Whelton, Ardfield, Clonakilty, Co. Cork ...	16
" ...	J. Megan, Donowen, Clonakilty, Co. Cork ...	16
" ...	F. Appleby, Carriganair, Skibbereen, Co. Cork ...	22
" ...	L. Cullen, Rathmore, Co. Wicklow	28
" ...	J. Leigh, Rampere, Baltinglass, Co. Wicklow ...	28
" ...	W. Coleman, Ballyduff, Co. Waterford	56
" ...	P. O'Connell, Athleague, Co. Roscommon ...	56

(*d*) *County Extension Plots—continued.*

Variety.	Name and Address of Grower.	Quantity of Seed supplied.
		Stones.
VICTORY II. ...	J. Skally, Lanesboro', Longford	14
,, ...	W. McAuliffe, Carrigatogher, Midleton, Co. Cork	28
,, ...	John Keegan, Carrigtwohill, Co. Cork	28
,, ...	M. Murphy, Garagh, Kinsale, Co. Cork ...	28
,, ...	E. Young, Belgooly, Kinsale, Co. Cork	28
,, ...	P. Ronayne, Castlemartyr, Co. Cork	28
,, ...	J. Brennan, Drummond, New Ross, Co. Wexford	28
,, ...	P. Kennedy, Hacketstown, Co. Carlow ...	14
,, ...	Wm. Moore, Canonsquarter, Tullow, Co. Carlow ...	14
,, ...	Andrew Byrne, Stephenstown, Naas	42
,, ...	P. Connolly, Caherconavan, Kilmihill, Doonbeg, Co. Clare	14
,, ...	P. O'Grady, Caherconovan, Kilmihill, Doonbeg, Co. Clare	28
,, ...	D. J. Horgan, Knockataggleheg, Killarney ...	28
,, ...	R. McCarthy, Craggaunoonia, Castleisland, Co. Kerry	28
,, ...	M. Darmondy, Mullinavat, Co. Waterford ...	21
,, ...	P. Moran, Parke, Turlough, Castlebar, Co. Mayo	42
,, ...	A. Foskin, Mullinavat, Co. Waterford	21
,, ...	R. McLoughlin, The Parks, Carndonagh, Co. Donegal	42
,, ...	J. O'Donoghue, Kilbrine House, Kanturk, Co. Cork	14
,, ...	B. O'Donoghue, Cullen, Millstreet, Co. Cork ...	14
,, ...	P. J. O'Loughlin, Barracurra, Newmarket, Co. Cork	28
,, ...	J. Mounsey, Riverlawn, Nenagh, Co. Tipperary ...	84
,, ...	D. Kenny, Tullameadow, Warrenstown, Offaly ...	42
	Total	1,148
SVALOF CROWN ...	D. O'Shea, Lackwest, Kilmihill, Kilrush, Co. Clare	28
,, ...	M. Callenan, Shian, Kilmihill, Doonbeg, Co. Clare	28
,, ...	D. O'Connell, Caherconavan, Doonbeg, Co. Clare ...	14
,, ...	T. O'Boyle, Doonfeeny, Co. Mayo	35
,, ...	R. Cummins, Piltown, Co. Kilkenny	28
,, ...	M. O'Shea, Jamestown, Piltown, Co. Kilkenny ...	14
,, ...	J. Piggott, Ballyhar, Killarney...	28
,, ...	P. O'Neill, Gowran, Co. Kilkenny	56
,, ...	P. Dwyer, Piltown, Co. Kilkenny	28
,, ...	J. Thompson, Clonaghill, Coolrain, Portlaoighise ...	42
,, ...	P. Owens, Linori, Baltinglass, Co. Wicklow ...	14
,, ...	P. Hickey, Skenanhore, Ballydehob, Co. Cork ...	16
,, ...	L. Keating, Rensboro', Glanworth, Co. Cork ...	70
,, ...	C. Dennehey, Ballygroman, Ovens, Co. Cork ...	52
,, ...	J. Lehane, Rockfarm, Carrigrohane, Co. Cork ...	32
,, ...	C. O'Sullivan, Dromkeen, Bandon, Co. Cork ...	44
,, ...	P. Gatley, Killigan, Knockeroghery	14
,, ...	M. O'Brien, Rockfield, Roscommon	14
,, ...	W. J. Burke, Bridge St., Skibbereen, Co. Cork ...	20
,, ...	P. Cummins, Carrigeen, Kilmacthomas, Co. Waterford	56
,, ...	Wm. Mee, Kiltoom, Athlone	70
,, ...	M. Neale, Dunhill, Tramore, Co. Waterford ...	70
,, ...	Wm. Smith, Dromoland, Newmarket-on-Fergus, Co. Clare	65
,, ...	E. Walker, Ballymacus, Kinsale, Co. Cork ...	42
,, ...	M. O'Brien, Ballymartin, Dungourney, Co. Cork	28
,, ...	L. M. Harris, Ballingaddy, Kilmallock, Co. Limerick	42
,, ...	John Clinton, Rockely, Dunleer, Co. Louth ...	28
,, ...	T. Cronin, Castleredmond, Midleton, Co. Cork ...	49
,, ...	J. Simpson, Ballymaloe, Cloyne, Co. Cork ...	84
	Total	1,111

(d) County Extension Plots—continued.

Variety.	Name and Address of Grower.	Quantity of Seed supplied.
		Stones.
POTATO I. ...	Patrick McGovern, Attavallie, Ballintubber, Claremorris, Co. Mayo	28
,, ...	John Sheridan, Mais, Tierworker, Bailieboro' ...	56
,, ...	Charles Gallen, Broomfield, Castlefin, Co. Donegal	70
,, ...	Wm. Doherty, Cashel, Gleneely, Co. Donegal ...	21
,, ...	R. McLoughlin, The Parks, Carndonagh, Co. Donegal	42
,, ...	Michael J. Cochran, Treman, Roscommon ...	14
,, ...	Richard J. O'Brien, Mullnaughten, Kiltoom, Athlone, Co. Roscommon	14
,, ...	Adam Donohoe, Bunnoe, Lisboduff, Cootehill, Co. Cavan	7
,, ...	Thomas McCaul, Lisboduff, Cootehill, Co. Cavan	14
,, ...	James Coyle, Lisboduff, Cootehill, Co. Cavan ...	7
,, ...	John Crossan, Drokabawn, Shercock, Co. Cavan	14
,, ...	Michael O'Brien, Dashallett, Shercock, Co. Cavan	14
,, ...	James Armstrong, Gartinadress, Cornafean P.O., Cavan	14
,, ...	John Beatty, Instructor in Agriculture, Technical School, Cavan	21
,, ...	Thomas Costello, Clough, Cummer, Ballyglunin, Co. Galway	16
,, ...	Charles Daly, Milltown, Tuam, Co. Galway ...	16
,, ...	James Kelly, Bredagh, Caltra, Ballinasloe ...	16
,, ...	G. C. Kelly, Instructor in Agriculture, Loughrea, Co. Galway	24
,, ...	James Duke, Stonepark, Elphin, Co. Roscommon	28
,, ...	Capt. McDermot, Drumdoe, Boyle, Co. Roscommon	14
	Total	450
BLACK TARTARY (New selection No. 1) ...	M. Darmody, Mullinavat, Co. Waterford ...	14
,, ...	W. Fahy, Glenis Island, Castlebar, Co. Mayo ...	28
,, ...	J. Hanton, Stonehouse, Saltmills, Co. Wexford ...	56
,, ...	T. Humphreys, Lyre, Banteer, Co. Cork ...	28
,, ...	N. Howlett, Ramsgrange, Co. Wexford	14
,, ...	Miss H. O'Keeffe, Garryhesta, Ovens, Co. Cork ...	80
,, ...	T. Gould, Castlemore, Crookstown, Co. Cork ...	72
,, ...	J. Lehane, Crossmahon, Macroom, Co. Cork ...	28
,, ...	J. McSweeney, South Main St., Bandon, Co. Cork	16
,, ...	J. Donovan, Ballinbrack, Ardfield, Co. Cork ...	16
,, ...	J. Crowley, Bealaghane, Dunmanway, Co. Cork ...	32
,, ...	M. Dineen, Brade, Union Hall, Skibbereen, Co. Cork	32
,, ...	J. Ahern, Ballyhooley, Co. Cork	84
,, ...	M. Tobin, Rathdrum, Tallow	56
,, ...	Rowan and Co., 51/52 Capel Street, Dublin ...	84
,, ...	C. McCarthy, Beal, Clonakilty, Co. Cork ...	16
,, ...	D. Keating, Prohonus, Skibbereen, Co. Cork ...	16
,, ...	P. Foskin, Deerpark, Mullinavat, Co. Waterford ...	42
,, ...	M. Kearney, Leap, Skibbereen, Co. Cork ...	32
,, ...	P. Leary, Dunmore East, Co. Waterford ...	56
,, ...	T. Hill, Glounties, Leap, Skibbereen, Co. Cork ...	16
,, ...	J. Kerwan, Rathvilly, Co. Carlow	14
,, ...	Wm. Burgess, Raheenbawn, Tullow, Co. Carlow ...	42
,, ...	J. Halligan, Blackwood, Sallins, Co. Kildare ...	84

(d) *County Extension Plots—continued.*

Variety.	Name and Address of Grower.	Quantity of seed supplied.
BLACK TARTARY (New Selection No. 1)		Stones.
...	M. Doorley, Prosperous, Sallins, Co. Kildare ...	48
,, ...	M. O'Brien, Ballymartin, Dungourney, Co. Cork	56
,, ...	J. O'Brien, Clonard, Youghal, Co. Cork ...	28
,, ...	T. McCarthy, Carrigtwohill, Co. Cork	28
,, ...	J. Collins, Sams Cross, Clonakilty, Co. Cork ...	32
,, ...	J. McCarthy, Lakemount, Inniskean, Co. Cork ...	28
,, ...	E. Boyd, Ballinglen, Co. Wicklow	28
	Total	1,206
BLACK TARTARY	A. H. Whitehead, The Maltings, Birr	70
,, ...	A. Connors, Ballymacandrick, Cloyne, Co. Cork ...	14
,, ...	J. Leahy, Innegrega, Ballinacurra, Co. Cork ...	70
,, ...	R. Hegarty, Broomfield, Midleton, Co. Cork ...	56
,, ...	W. McBride, Merchant's Quay, Cork	140
,, ...	J. Hyde, Ballinacurra, Co. Cork	77
,, ...	D. Higgins, Ballydaniel, Cobh, Co. Cork ...	32
,, ...	Drummond and Sons, Dawson St., Dublin ...	280
,, ...	P. Lynch, Ballybraher, Cloyne, Co. Cork ...	14
,, ...	Wm. Higgins, Ballingrane, Cloyne, Co. Cork ...	21
,, ...	J. O'Callaghan, Castlebar, Co. Mayo	28
,, ...	J. Twomey, Castlelyons, Fermoy, Co. Cork ...	42
,, ...	C. Byrne, Keatingstown, Co. Wicklow	42
	Total	886

FLAX.

I.—PROPAGATIONS.

The following propagations of pure line selections of flax were cultivated at Ballinacurra Cereal Station during the season :—

(a) *Single Plant Selections :*

Department's Pure Lines Nos. 2, 3, 5 and 6.
Danish Pedigree Nos. 7, 21 and 40.
J.W.S. x White Flowering No. 21.
9 Selections No. 6 x White Flowering.

(*b*) *Garden Plots :*

Department's Pure Line No. 2.		
Do.	do.	6.
Danish Pedigree No. 21.		
Danish Pedigree No. 40.		
J.W.S. ex Canada.		
Department's No. 6 x White Flowering		6/1.
Do.	do.	10/1.
Do.	do.	10/2
Do.	do.	10/3.
Do.	do.	11/1.
Do.	do.	13/1
Do.	do.	13/2
Do.	do.	13/4
Do.	do.	21/1.
J.W.S. x White Flowering No. 21.		

(*c*) *Extension Plots :*

	Area.
Danish Pedigree No. 21	$\frac{1}{2}$ stat. acre.
J.W.S. ex Canada	$\frac{1}{8}$,,
Department's Pure Line No. 6 ...	$\frac{1}{2}$,,
Department's Pure Line No. 2 ...	$\frac{1}{2}$,,

II.—Experiments.

During the season of 1928 experiments were conducted with the object of determining—

(*a*) The relative values of five different varieties.

(*b*) The influence of a dressing of artificial manures consisting of $\frac{1}{2}$ cwt. Sulphate of Ammonia and $1\frac{1}{2}$ cwt. Muriate of Potash per statute acre.

(*c*) The effect of substituting nitro-chalk for Sulphate of Ammonia in the mixture of artificial manures applied to the crop.

Trials were conducted at eight centres in the flax growing areas and at each centre seven plots were laid down. One plot received no artificial manures. Another plot was dressed with a mixture consisting of $1\frac{1}{2}$ cwt. Muriate of Potash and the Nitrogen equivalent of $\frac{1}{2}$ cwt. of Sulphate of Ammonia in the form of nitro-chalk per statute acre. Each of the remaining plots received a dressing of $1\frac{1}{2}$ cwt. Muriate of Potash and $\frac{1}{2}$ cwt. Sulphate of Ammonia per statute acre.

The average returns from the various plots are set out in the following Table :—

AVERAGE RETURNS PER STATUTE ACRE (8 Centres).

No. of Plot	Variety.	Manure applied per Statute Acre.	Yield of Scutched Flax.		Percentage of Scutched Flax from Retted Straw.	Value of Scutched Flax per stone. *		Return from Scutched Flax.		
			st.	lbs.		s.	d.	£	s.	d.
1	Danish Pedigree No. 21	½ cwt. Sul. of Am. 1½ cwt. Mur. of Potash.	34	8	14·6	12	2½	21	2	1
2	"J.W.S." Canadian ...	do.	33	8	13·6	11	11	20	0	1
3	Department's Pure Line No. 6.	do.	28	5	12·5	12	1	17	2	8
4	Department's Pure Line No. 2.	do.	26	2	11·5	11	8	15	5	0
5	Riga	do.	26	12	12·7	12	1	16	4	6
6	Riga	1 cwt. Nitro-Chalk 1½ cwt. Muriate of Potash.	28	13½	13·3	12	4	17	17	3
7	Riga (Unmanured) ...	None	26	9	13·5	12	4	16	8	7

* The flax grown on each plot at each centre was valued separately; these figures represent the average of the valuations.

As in similar trials conducted in the previous year Danish Pedigree 21 again gave the best returns. The Department's Pure Line No. 6 produced a better yield than Riga Flax but in this respect it proved distinctly inferior to J.W.S (Canadian).

Practically similar results were obtained from the unmanured plot of Riga flax and the plot sown with the same variety and dressed with the mixture of Sulphate of Ammonia and Muriate of Potash. In similar trials conducted in previous years appreciably better results were, however, obtained where the dressing of artificial manures was applied. A better yield was obtained where nitro-chalk was employed as the source of nitrogen than where sulphate of ammonia was used and although it is not advisable to draw definite conclusions from one season's trials it is evident that nitro-chalk can be substituted for sulphate of ammonia in the manurial dressing for the flax crop with satisfactory results.

INVESTIGATION INTO THE RELATION OF SOIL CONDITIONS TO FAILURES IN THE BEET CROP 1928.

By Patrick H. Gallagher, D.Sc., Ph.D. (Cantab.), *Faculty of Agriculture, University College, Dublin.*

First Report.

In October, 1928, an investigation was commenced into a number of cases in which failures in the sugar-beet crop had been reported. It was the purpose of this enquiry to determine whether the crop results could in any way be correlated with soil conditions. The initial examination of soil samples collected from the affected areas has given such striking results that it has been deemed advisable to present this preliminary report to enable the question of testing or adopting remedial measures in the coming season to be amply considered.

In the course of this investigation about one hundred soil samples have been examined from the beet crops on the following farms:—

1. Mr. J. Maguire, Galtrumsland, Bush, Co. Louth.
2. Mr. Th. O'Rourke, Lower Rath, Carlingford, Co. Louth.
3. Mr. John Feehan, Monksland, Carlingford, Co. Louth.
4. Mr. John Lowe, Monksland, Carlingford, Co. Louth.
5. Mr. Campbell, Crinstown, Ardee, Co. Louth.
6. Mr. Samuel Cope, Knocknagee, Co. Kildare.
7. Mr. F. Wright, Prumplestown, Co. Kildare.
8. Miss Jackson, Kilkea, Co. Kildare.
9. Mr. Somers, Dunsinane, Enniscorthy, Co. Wexford.
10. Colonel Loftus Bryan, Borrmount, Edermine, Co. Wexford.
11. Mr. P. Kehoe, Glencarrig, Co. Wexford.
12. Mr. J. Furlong, Knockreigh, Adamstown, Enniscorthy.
13. Mr. G. Warren, Clonhenret, Gorey.

This report is divided into three sections. The first deals with the failures in the Carlingford area, the second section with failures due to disease in Counties Louth and Kildare, and the third with a series of failures in Co. Wexford where no disease was apparent.

Section 1.

The Carlingford Failures.

The failures on the farms in the Carlingford area were the first to be examined. The district was visited on October 18th. In Mr. Maguire's field at Galtrumsland there were a couple of patches about twenty to thirty feet in diameter which were completely devoid of beet. The main

portion of the crop, however, might be described as moderately good, individual beets being comparatively well developed and healthy. It was noticed that while the soil in most of the field appeared capable of growing quite good roots, considerable gaps in the drills where the plant had failed to grow at all were everywhere evident. On Mr. Feehan's farm conditions were of a similar character. Although the gaps in the crop in this case were more widespread and serious than at Mr. Maguire's, roots which were individually sound and normal were to be found here and there throughout the entire field. Mr. Feehan's field also contained mangels and turnips. It is to be noted that though the mangel crop showed gaps in the drills similar to, though less serious, than in the case of the sugar beet, the turnip crop on the other hand was quite uniform. In Mr. O'Rourke's field, while the characteristic features of the two other crops mentioned were still maintained in so far as most portions of the field appeared capable of producing healthy roots here and there, the presence of any root at all might in this case be described as the exception. The crop as a whole was about ninety per cent. failure. Mangels in this field showed a similar appearance.

Soil samples were taken from all three fields, an attempt being made to take one sample in each case from the worst portion of the crop and a second from the best part for the purpose of comparison. In Mr. O'Rourke's field no part of the crop could be called good. A soil sample was also taken for comparison from a field of good average beet on the farm of Mr. John Lowe, situated nearly midway between the three fields above-mentioned. The laboratory examination of these soils has so far failed to reveal any particular property to which a failure of the beet crop could reasonably be ascribed. All of the soils appear to be of the same geological formation. They overlie limestone and noticeably contain limestone, sandstone and granite detritus. The soil reaction in each case is given in the following Table in terms of hydrogen-ion concentration:

Soil No.	Location	pH.
L. 1	Surface sample from relatively *bad* part of crop on Mr. Maguire's farm	8·02
L. 2	Surface sample from relatively *good* part of crop on Mr. Maguire's farm	8·09
L. 3	Surface sample from generally bad crop on Mr. O'Rourke's farm ...	6·18
L. 4	Taken from relatively *bad* crop on Mr. Feehan's farm	6·54
L. 5	Taken from relatively *good* part of crop on Mr. Feehan's farm ...	6·25
L. 6	Taken from generally good crop on Mr. Lowe's farm	6·71

It will be noticed that the soil L 6, which produced a good crop of beet, is nearly neutral in reaction. The soil on Mr. Maguire's field is distinctly alkaline, that on Mr. O'Rourke's land is quite acid, while Mr. Feehan's is less acid than Mr. O'Rourke's. The samples taken from the good and bad portions of the crops on Mr. Feehan's and Maguire's farms show no

significant mutual differences. The accentuated failure of the crop on Mr. O'Rourke's land can scarcely be attributed to soil acidity, because, as will be shown further on, excellent beet has been found on soils somewhat more acid than this in Co. Kildare and elsewhere in Co. Louth.

The Carlingford failures appear to be attributable to the physical rather than to the chemical nature of the soil. It contains a considerable quantity of stones and coarse gravel and was noticeably in bad tilth when inspected in October. That it would furnish an inhospitable seed-bed for a crop such as beet is evident, particularly were the weather unfavourable at the time of sowing. Mr. O'Donovan, the Agricultural Instructor for Co. Louth, was disposed to attribute the failure to the combined adverse effects on germination of climatic conditions and of a coarse open soil. The facts of the case point to this explanation as the most likely one.

Section 2.

THE RELATION BETWEEN PHOMA OR CROWN ROT IN BEET AND SOIL REACTION.

On October 20th Mr. C. O'Donovan, the Agricultural Instructor for County Louth, forwarded for examination two soil samples from the farm of Mr. Campbell, of Crinstown, Ardee, Co. Louth. One of these was taken from a portion of the beet crop which was badly infected by phoma betae. The other was taken from the healthy portion of the same crop. The investigation of these two soil samples revealed striking differences in that the one taken from the diseased part of the field contained an abundance of carbonate, while the other was nearly free from this substance. The determination of hydrogen-ion concentration revealed an equally striking difference, the soil from the diseased portion of the field being distinctly alkaline (pH 8.0), while that from the healthy portion of the crop was quite acid (pH 5.7).

In company with Mr. O'Donovan I accordingly visited Crinstown on October 30th. A plan of the field at Crinstown is shown in Fig. 1. Sugar beet was grown along the south side of the field. Between this and the northern half of the field a potato crop was grown, while the north half was devoted to beet and mangels. The diseased patch from which Mr. O'Donovan had furnished the soil sample was in the middle of the beet plot along the south hedge. The patch was semi-circular in shape and about thirty yards in diameter, the base of the semi-circle running along the potato drills. The whole of this patch was occupied by very small diseased roots with scarcely any foliage other than a few small recently-sprouted leaves. The border of the patch was remarkably well defined, it being possible in most parts to pass within the space of three or four feet from small badly-diseased roots on the border of the crude semi-circle to perfectly healthy roots beyond.

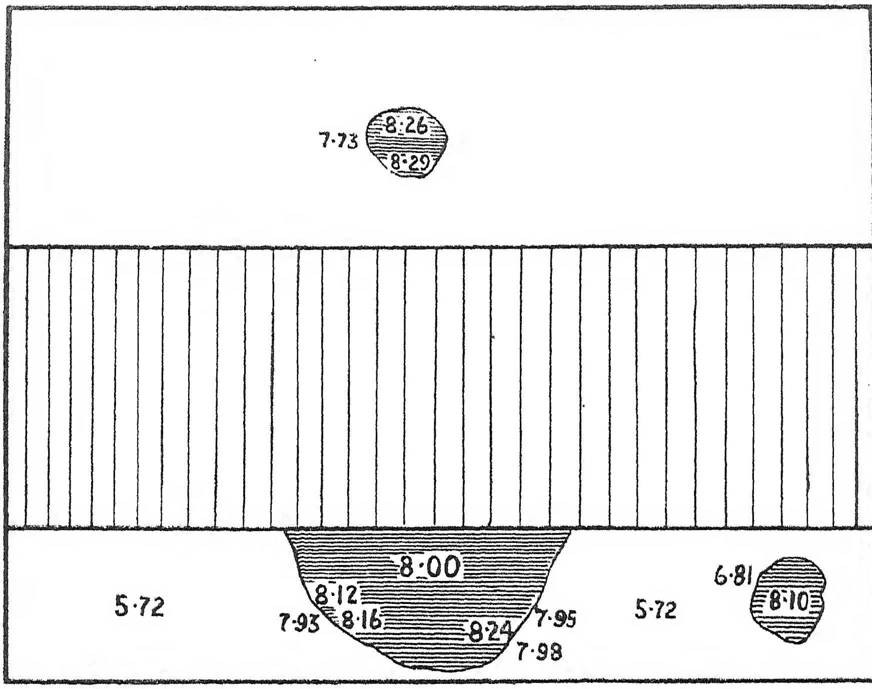


Fig. 1—Plan of field at Crinstown. Horizontally shaded parts represent diseased patches in beet (and mangels). Vertical shading represents potato crop. Numerals refer to hydrogen-ion concentrations of surface soil.

In view of the possibility that the spread of disease was dependent on some soil factor a number of soil samples was taken as near as possible to each other on the healthy and diseased sides of the border in the hope of throwing some light on the limiting condition at which this soil factor begins to favour the disease. The complete analysis by one individual of these and other samples taken in the course of this investigation will occupy a very considerable period, and relatively few results are yet available, but all the qualitative tests so far made show a distinct difference in lime content between samples taken from within and without the diseased patch even when these were separated from each other by as little as four feet. A number of sub-soil samples were also taken, all of which appear to have a very abundant lime content. In one place, at a depth of about fifteen inches a bed of white marl was reached.

At the south-eastern end of the field at Crinstown there was a second patch of diseased beets. This corner of the field was at a somewhat higher elevation than the rest of the field, and the injury was more circumscribed than in the case of the diseased plot already mentioned. A soil sample taken in the middle of the diseased patch in this second instance again showed a distinctly greater lime content than a sample taken among healthy roots only fifteen feet away. There was again a very distinct difference in hydrogen-ion concentration, the soil in the centre of the diseased patch being pH 8.1, while that among healthy roots fifteen feet away was only pH 6.8.

There was a third diseased area in the northern half of Mr. Campbell's field at Crinstown, and the diseased roots within its circumference included both beet and mangels. In this case again the surface soil on which the crop was diseased showed a considerably greater lime content than soil taken among healthy roots in the immediate vicinity.

Hydrogen-ion concentration measurements are available for all the samples taken and these are collected in Table 1 on page 66. The position from which each sample was taken may be seen by reference to Fig. 2.

Discussion on the hydrogen-ion Concentration of the Crinstown surface samples.

The samples taken in the centre of each portion of the normal healthy beets on the south side of the field indicate that the main part of the successful portion of the crop is growing on an appreciably acid soil of pH 5.7. All of the diseased areas, on the other hand, are characterised by distinct alkalinity, no measurement less than pH 8.0 being recorded on any part of the field where the crop suffered seriously from the disease. The samples taken among healthy roots on the borders of the diseased patches, although quite alkaline in some cases, never exceeded a hydrogen-ion concentration of pH 8.0, although some of these samples were taken within a foot or two from where the crop had practically been obliterated by disease.

These results would suggest that the attack of the beet crop by phoma or crown-rot is favoured by alkalinity of the soil and that under the climatic and soil conditions prevailing at Crinstown the limiting soil reaction at which the beet crop is seriously affected by the disease is pH 8.0. Below this reaction the crop appears capable of resisting the disease; above this reaction the crop succumbs.

Prevalence of Phoma betae or Crown Rot on the Continent.

While it is not proposed to enter into a discussion as to whether phoma is the prime or only cause of the diseased condition of the plants studied in the present investigation, it may be mentioned that all the cases of crop failure referred to in the present section were characterised by the presence of phoma betae on the leaves and petioles of the plants concerned.[1]

[1]Although phoma betae is invariably present in this disease, the pathological relationship of this organism to the diseased plant does not appear to be clearly understood. Under the circumstances, therefore, the disease might be better described as "crown-rot," or by the continental term "heart-rot" (Fr., pourriture du coeur; Gr., Herzkrankheit), rather than as "phoma." Attempts to induce "heart-rot" in beet by means of phoma betae do not appear to have been uniformly successful; but lack of success in this respect may obviously be due to the lack of necessary soil or nutrient conditions, as the results presented in this report indicate. MM. Delacroix and Maublanc, plant pathologists to the Institut National Agronomique, attribute heart-rot to the fungus *Sphaerella tabifica*, of which *Phoma tabifica* (Prill. and Del.) or *Phoma betae* (Frank) are pycnids.

MM. Delacroix and Maublanc also distinguish a second type of heart-rot which is popularly known in France as beet-mildew. This disease is recognisable by the deformation, thickening and brittleness of the leaves of the young plant. The leaves also assume a somewhat violet tint and eventually become pale and yellow. A disease answering closely to this description has been observed in the 1929 crop in Ireland. It is attributed by the authorities just mentioned to the organism *Peronospora Schachtii*, and unlike common heart-rot is said to be favoured by humid rather than by dry climatic conditions. Beet-mildew appears to be independent of phoma.

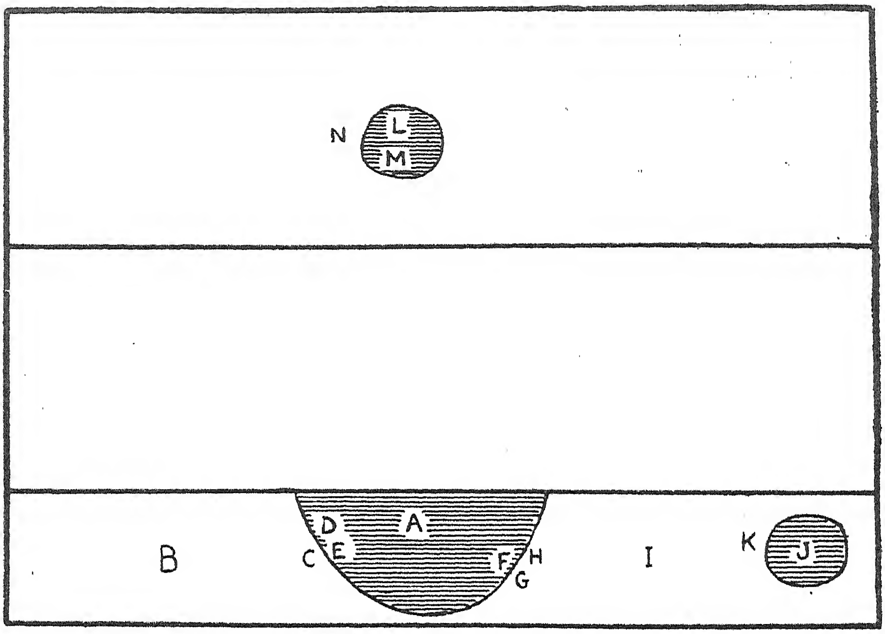


Fig. 2.—PLAN OF BEET CROP AT CRINSTOWN. Shaded parts represent diseased areas and letters indicate places where soil samples were taken.

TABLE 1.

pH. of Samples from *diseased* areas.

Soil No.	Position in plan.	Position relative to other samples	pH. of surface (9″).	Sub-soil No.	pH. of sub-soil.
L. 10	A	Centre of large diseased area ...	8·00	—	—
L. 15	D	7 feet from C	8·12	—	—
L. 16	E	6 feet from C	8·16	L. 17	8·33
L. 18	F	4 feet from G and 6 feet from H ...	8·24	L. 19	8·10
L. 25	J	15 feet from K	8·10	L. 26	9·48
L. 28	L	7 feet from M and 13 feet from N ...	8·26	L. 29	8·61
L. 30	M	7 feet from L and 13 feet from N ...	8·29	L. 31	8·52

pH. of Samples from *healthy* areas.

Soil No.	Position in Plan.	Position relative to other samples.	pH. of surface (9″).	Sub-soil No.	pH. of Sub-soil.
L. 11	B	Centre of healthy beet on west of large bad area.	5·72	—	—
L. 13	C	7 feet from D and 6 feet from E ...	7·93	L. 14	8·31
L. 21	G	4 feet from F	7·98	—	—
L. 22	H	6 feet from F	7·95	L. 23	8·20
L. 24	I	Centre of healthy beet on east side of large bad area.	5·72	—	—
L. 27	K	15 feet from J	6·81	—	—
L. 32	N	13 feet from L and M.	7·73	L. 33	8·26

Phoma is frequently met with on the Continent and in dry seasons particularly it causes considerable damage to the beet crop. It is recognised on the Continent that phoma is specially favoured by soil alkalinity and by drought. Ernst Gäumann of Zurich issued a report on an investigation into the occurrence of phoma in the beet crop on various Swiss soils in 1925.[1] Gäumann's report shows that the attack on the crop usually takes place in patches here and there in the field, as already described at Ardee. He studied the soil by the hydrogen-ion concentration method and found that the diseased patches were relatively more alkaline than where the beet was healthy in the same field. Gäumann indicates the limiting reaction for the Swiss soils studied as approximate neutrality (about pH 7). The limit so far determined under Irish conditions is appreciably higher (pH 8.0), which is particularly fortunate, because were the disease to assume epidemic form in Ireland at pH 7.0 a considerable percentage of our limestone soils would be rendered unsuitable for beet cultivation in consequence. Although all of the cases of phoma so far studied in Ireland have been found associated with a relatively high proportion of carbonate in the soil, there are ample indications that it is not calcium carbonate, but a still more alkaline factor in the soil which is the cause of the excessive alkalinity which seems responsible for the disease here in Ireland.

That phoma should manifest itself above pH 7.0 in Switzerland while it remains relatively passive in Ireland below pH 8.0 would seem in all probability to be due to climatic factors. If the disease is favoured by drought, it is easy to understand why it should assert itself more readily in a dry climate than in one which is moist.

Further Study of Phoma-infected Areas.

On November 15th I visited a number of farms in the neighbourhood of Carlow where phoma-infected areas existed in the beet crops. The condition of the diseased beets and the patchy nature of the crops examined in the Carlow district generally resembled those of the Crinstown case already described. Soil samples were collected from three farms on the Co. Kildare border and the results of the laboratory examination of these will be given under separate headings.

Beet Crop of Mr. Frederick Wright, Prumplestown, Co. Kildare.

The greater part of the beet crop raised on this farm appeared to be of excellent quality, but on one side of the field, not more than from ten to fifteen yards from the hedge, there were two more or less circular patches where an attack of phoma was very evident. These patches were about fifty yards apart and each was practically devoid of vegetation, though surrounded by normal healthy plants. Reference to Fig. 3 on page 68 will show the positions from which soil samples were taken. The hydrogen-ion concentrations of the three surface samples from within the phoma-

[1] Ernst Gäumann: "Untersuchungen über die Hertzkrankheit der Runkel-und Zuckerrüben."—Beiblatt zur Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich. No. 7, 1925.

infected areas were pH 8.15, pH 8.00 and pH 8.09. A sample taken among healthy beets about four or five feet away from the edge of one of the phoma-infected areas showed a hydrogen-ion concentration of pH 7.15. It is interesting to note that a further soil sample taken in the middle of the field nearly one hundred yards from the phoma areas showed a hydrogen-ion concentration as low as pH 6.0. This sample was taken among beet which would be considered above the average in quality.

It is interesting to note that in this case also the qualitative examination for soil carbonate reveals the fact that soil from the infected areas shows a high content of this substance, as compared with soil from non-infected portions of the same field.

These results entirely corroborate the conclusions arrived at in the case of the Crinstown samples.

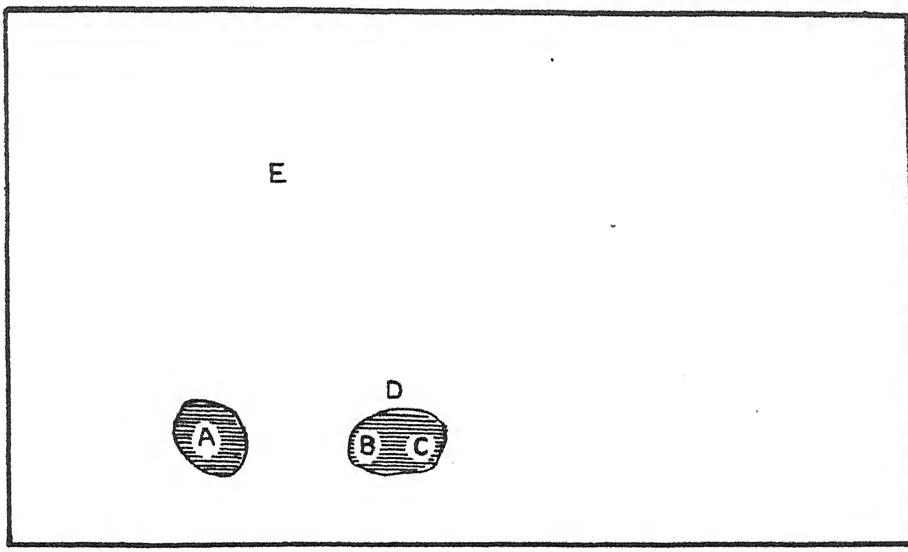


Fig. 3.—PLAN OF BEET CROP AT PRUMPLESTOWN.

TABLE 2.—pH. of samples from *diseased* areas.

Soil No.	Position in Plan.	Position relative to other samples.	pH. of surface (9″).	Sub-soil No.	pH. of Sub-soil.
Kd. 20	A	From centre of first phoma area ...	8·00	Kd. 21	8·09
Kd. 16	B	From middle of second phoma area	8·14	Kd. 17	8·09
Kd. 18	C	From middle of second phoma area	8·15	—	—

pH. of samples from among *good* beet.

Kd. 19	D	About four feet from edge of phoma area.	7·15	—	—
Kd. 14	E	Among very good beet, about 100 yards from phoma areas.	6·00	Kd. 15	6·67

Beet Crop of Mr. Samuel Cope, Knocknagee, Co. Kildare.

This crop was visited on November 16th. The destruction due to the disease characterised by the presence of phoma was much more widespread in this case than on any of the other farms inspected. The field, which was about twelve acres in extent, rose to a long flat ridge towards the centre. The entire top of this ridge was covered with diseased beet which showed but feeble signs of vegetation. The disease was by no means confined to this ridge, but continued to the low-lying ground to the left of the field (as regarded from the roadway.). Here and there throughout the remainder of the field smaller patches of phoma infection were to be found. These in no way contrasted in contour with the healthy crop in the neighbourhood.

While the tests made on samples from this field agree with the general principles already laid down, in that samples from the diseased portions of the field are more alkaline and show a higher carbonate content than those from among healthy beets in the immediate vicinity, at the same time we witness a departure from the rule already observed, that phoma is invariably destructive above pH 8.0, but never below.

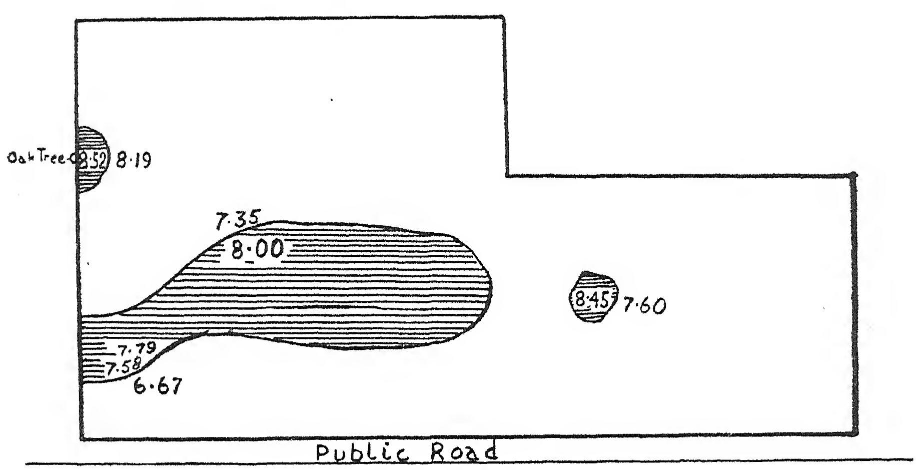


Fig. 4.—Plan of Beet Crop at Knocknagee. Shaded parts represent diseased beet. The figures refer to hydrogen-ion concentrations of surface soil.

Two sets of comparative samples were taken among good and among diseased beet, one pair on the top of the long ridge in the centre of the field and the other pair at a small clearly defined phoma patch shown on the right-hand side in Fig. 4. Each pair showed similar mutual difference in hydrogen-ion concentration and in carbonate content (speaking qualitatively) as in the case of samples from Crinstown and Prumplestown. Thus, while the samples from the infected areas showed the values pH 8.00 and 8.45, the

samples from among healthy roots in the vicinity were pH 7.35 and pH 7.60, respectively. The ridge already referred to sloped downwards rather sharply towards the hedge on left. In the low ground, surface samples taken among diseased plants showed hydrogen-ion concentrations as low as 7.79 and 7.58. The acidity of the soil among good beet in the immediate vicinity was pH 6.67.

While the activity of a disease such as phoma necessarily depends on variable factors other than hydrogen-ion concentration, it would be unreasonable to expect a limiting condition for the disease, such as pH 8, to be rigidly adhered to. It will be remembered that Gäumann fixes the limit near pH 7.0 in the case of Swiss soils. Neither drought nor dryness of the soil appear capable of explaining the fall in the hydrogen-ion concentration value recorded among diseased roots in the present instance. It is worthy of note that the sub-soil beneath the diseased beets at this part of the field shows the unusual feature of being considerably more acid than the surface soil. Thus, where the surface is pH 7.58, the sub-soil is pH 6.60, and where the surface is pH 7.79, the sub-soil is pH 7.40. Judging by the diminutive size of the diseased beets in general, they were evidently attacked by the disease at an early stage and it is possible that a soil sample taken at a depth of nine inches includes more of the acid sub-soil than would have been in contact with the roots when they become diseased.

A further interesting case in the same field is connected with a small semi-circular patch of diseased roots along the left-hand side of the hedge as shown in diagram. An oak-tree in the hedge formed a geometrical centre to the diseased area. Recollecting that the virulence of phoma is favoured by drought, it appeared possible that the root-system of the tree might, through transpiration, be a factor in causing the disease. Examination of the soil samples showed that taken to a depth of nine inches among the diseased roots at a distance of seven yards from the tree, the soil had a hydrogen-ion concentration of pH 8.5. On the other hand a sample taken among good beet fifteen yards from the tree had a hydrogen-ion concentration of 8.19. This is an instance of beet maintaining healthy growth above pH 8. The two sub-soils in the present instance are among the most alkaline hitherto recorded in Ireland, being pH 8.81 beneath the diseased roots and 8.77 beneath the others.

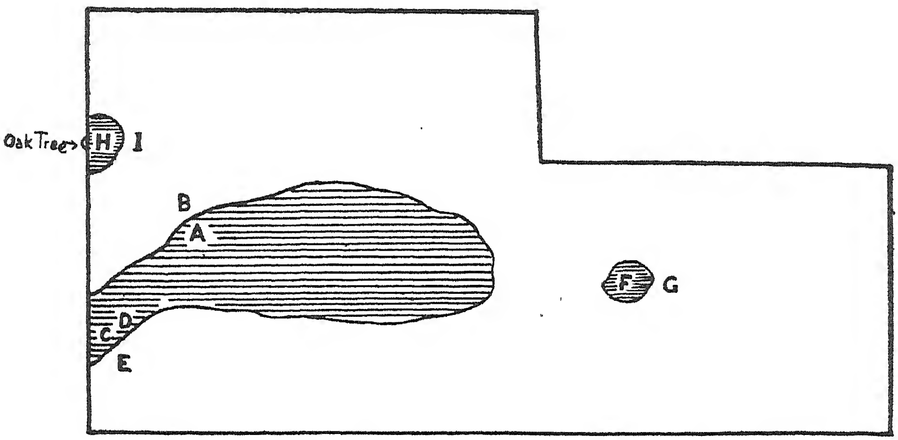


Fig. 5.—PLAN OF BEET CROP AT KNOCKNAGEE, CO. KILDARE.

TABLE 3.—pH. of samples from *diseased* areas.

Soil No.	Position in Plan.	Position relative to other samples.	pH. of surface (9″).	Sub-soil No.	pH. of Sub-soil.
Kd. 10	A	From among diseased beets on top of ridge.	8·00	Kd. 11	8·10
Kd. 29	C	From diseased patch on low ground	7·79	Kd. 30	7·40
Kd. 7	D	From diseased patch on low ground	7·58	Kd. 6	6·60
Kd. 22	F	From centre of small diseased area on right of ridge.	8·45	Kd. 23	8·76
Kd. 25	H	In diseased area, seven yards from tree	8·52	Kd. 26	8·81

pH. of samples from *healthy* areas.

Kd. 12	B	Among good beet, 20 feet from A ...	7·35	Kd. 13	7·15
Kd. 9	E	Among good beet, about 20 feet from C and D.	6·67	Kd. 8	7·03
Kd. 4	G	Among good beet about 13 feet from F	7·60	Kd. 24	8·33
Kd. 27	I	8 yards from H	8·19	Kd. 28	8·77

Beet Crop on the farm of Miss Jackson, Kilkea, Co. Kildare.

The special feature in this case was a relatively large semi-circular phoma patch in the crop, apparently centred by a large tree in the hedge as in the case at Knocknagee, already described. In the present instance the tree was a well-developed beech. In spite of the size of the tree it is questionable whether its root-system could have fully extended to the extreme limit of the diseased area of beet. Nevertheless, the semi-circular formation of the diseased area of beet, with the large tree in the hedge as a centre, formed, to say the least, a curious coincidence. Nor was this the only curious feature of the case. Within a distance of three or four feet from the edge of the highway along the hedge most of the beets grew tolerably well, though phoma was evident here and there. Beyond this narrow belt of tolerably good beet the field was practically bare for a considerable distance. The general features of the case are represented in Figure 3.

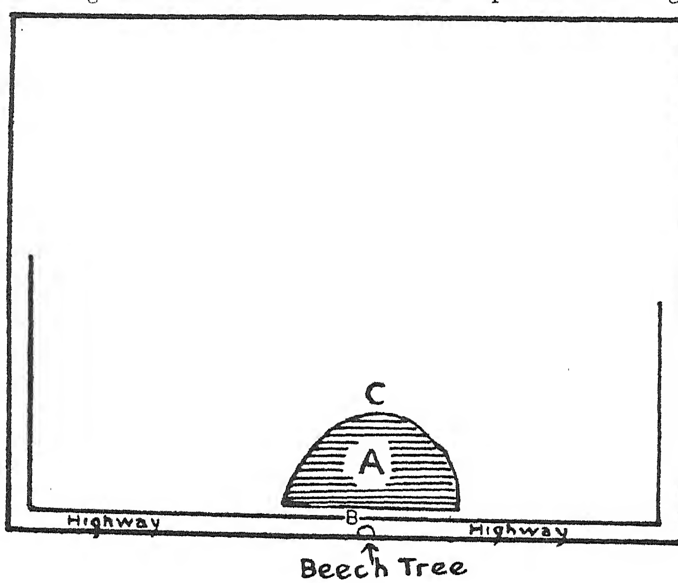


Fig. 6.—PLAN OF BEET CROP AT KILKEA, CO. KILDARE. Shaded portion represents phoma-infected area.

Three surface soil samples were taken, A in the centre of the plot from which the crop had been practically eliminated by disease, a second, B, in the belt of beet along the highway adjacent to the phoma area and C, among good beet a few feet from the edge of the phoma area on the side farthest from the tree. The hydrogen-ion concentrations of these samples are given in the following table:

TABLE 4.

Soil No.	Position in Fig. 3.	Position in field.	Hydrogen-ion Concentration.
Kd. 2	A	Centre of badly diseased beet	pH. 8·00
Kd. 3	B	In belt of tolerably good beet near highway ...	pH. 8·02
Kd. 1	C	From main part of crop, among good beet ...	pH. 6·66

These figures again bear out the relation of phoma to soil alkalinity, and the immunity of beet to this disease when grown on an acid soil. In this case also, the alkaline soil samples appear to contain an abundance of carbonate. It is of particular interest to note that no appreciable difference in hydrogen-ion concentration was apparent between the large region in which the crop had completely succumbed to disease and the narrow belt between this region and the highway, in which considerable growth was maintained. In seeking an explanation for this it is necessary to remember that the alkaline region in which growth continued was not only at the end of the drills at the bottom of the field, but it was alongside unploughed ground: a combination of circumstances which would tend to favour moister soil conditions and consequently militate against an attack of phoma.

General Conclusions.

In the course of this investigation the general physical character and situation of the soils concerned was not lost sight of from the point of view of possibly explaining the prevalence of disease from some such aspect. In all cases, however, the soils appeared to be good cultivable loams and excluding those parts of the fields where phoma was evident, the main portion of the crop in each case, with perhaps the exception of that at Knocknagee, left little or nothing to be desired.

The results of this investigation justify the general inference that *here in Ireland phoma is a serious menace on soils of reaction pH 8.0 or over.* In only one case were healthy beets found on a soil appreciably exceeding this reaction and in but one case, in the same field, were badly diseased roots found on soil of less than this reaction. While it must be remembered that the critical reaction may vary from pH 8.0 under the influence of other varying soil factors, these two exceptional cases may nevertheless be due to admixture of exceptionally alkaline sub-soil with the surface-soil in sampling in the former case, and to a similar admixture of acid sub-soil in the latter.[1]

It appears likely, therefore, that if in beet cultivation the soil reaction can be kept below pH 8.0, serious damage to the crop from phoma should be eliminated.

It has already been mentioned that the soil samples taken among diseased roots show evidence of a high carbonate content as compared with the soil from among healthy roots growing in the vicinity.

Though quantitative estimates are not yet available, this difference has been qualitatively noted to be a general rule.

While calcium carbonate is the most important and widespread soil constituent capable of maintaining the soil in a non-acid or in an alkaline condition there is reason to believe that the pronounced alkalinity of the

[1] It is necessary to remember that this survey did not extend beyond a number of fields in which infection was known to exist. Although phoma is usually classified as a seed-borne disease, it is impossible to be certain as to what extent infection may be present either in the seed or in the soil of the beet-growing district as a whole. In the absence of a general survey of this district one cannot say to what extent soils exceeding pH8 may, through possible lack of infection, have remained immune from the disease up to the present year.

soils on which phoma was virulent cannot be entirely explained on the basis of calcium carbonate content alone. The solubility and alkalinity of calcium carbonate both depend on the quantity of free carbon dioxide which is present in the solution. Under conditions of equilibrium the proportion of carbon dioxide in the solution will depend on the relative quantity, or partial pressure, of carbon dioxide in the surrounding atmosphere. A solution of calcium carbonate in equilibrium with the small proportion of carbon dioxide in the air has a hydrogen-ion concentration of pH 8.4. The soil atmosphere, however, is known to contain carbon dioxide in considerably greater proportion than does ordinary air, hence the reaction exerted by calcium carbonate in the soil must necessarily lie considerably below pH 8.4. The atmosphere of ordinary arable soils has been found to contain carbon dioxide within the limits of 0.3-3.5 per cent. A proportion of 3.35 per cent. of carbon dioxide in the atmosphere would be sufficient to render calcium carbonate absolutely neutral.

In the present investigation values as high as pH 8.8 have been obtained for subsoil and pH 8.5 for surface soil. These figures point to the presence of some substance in these soils more alkaline than calcium carbonate. From a few tests already carried out *it seems likely that the substance to which the somewhat abnormal alkalinity associated with virulent attacks of phoma is due is magnesium carbonate.* Magnesium carbonate, because of its basic nature and its relatively greater solubility, exerts a considerably more alkaline reaction than calcium carbonate.

Preventive Measures.

The foregoing results suggest that it should be possible to combat infection by phoma by resorting to treatments which would reduce the alkalinity of the soil. Experiments are in progress to determine whether remedies of this nature are practicable.

Section 3.

BEET FAILURES ASSOCIATED WITH SOIL ACIDITY.

All of the failures in the beet crops which have been described in the preceding section of this Report were due to disease. The present section deals with cases where, at the time of inspection, no disease whatsoever was apparent, although the crops had failed either wholly or in part.

On November 16th I visited two farms in the neighbourhood of Enniscorthy where failures had been recorded. The first of these farms was that of Mr. Somers at Dunsinane. The main portion of the beet crop on this farm was tolerably good and regular, but on about ten drills across the entire width of the field there was almost a complete absence of plants. The affected drills were known to have received slightly different treatment from the rest of the field at the time of ploughing. The soil in the field generally was rather loose and stony. It was evidently of silurian origin and appeared to be free from limestone. A soil sample was taken where the crop had failed and a further sample was lifted about 24 feet away among good beet. Both of these samples were quite acid, and equally so, as was also the sub-soil. The exact figure recorded in each case was pH 4.92. Comment on this case will be reserved till later.

The second farm visited in this area was that of Colonel Loftus Bryan at Borrmount. In this case the failure was much more widespread than at Dunsinane. Were one to judge the soil by appearance it could be pronounced quite suitable for beet. It was a good deep loam on which beet had been planted with considerable optimism. A plan of the field is given in Fig. 7.

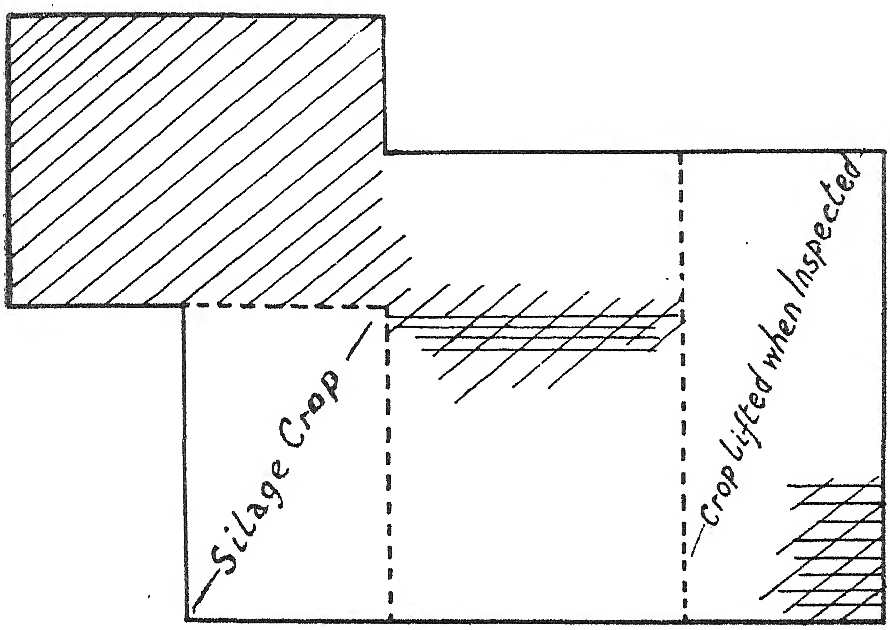


Fig. 7.—Plan of Beet Crop at Borrmount.

The entire field was thirteen acres in extent. That portion of the crop in the rectangular space to the right in diagram had been lifted at the time the field was visited. A silage crop had been raised in the rectangular space at bottom left. The region in which beet had completely failed in the remainder of the field is shown by diagonal shading. Most of the crop which did grow might be described as somewhat mediocre.

The field at Borrmount was visited after a night's heavy rainfall. It was noticed that the parts of the field shaded horizontally were quite water-logged. The horizontal shading in the centre of the diagram coincides with the site of a former ditch. While, therefore, lack of sufficient drainage helps to explain the condition of the beet in several parts of the field, it can scarcely explain the poor condition of the crop as a whole.

It is to be noted that a number of fertilizers trials were laid down in the field and the best results were obtained on a number of drills which had been treated with ground lime at the rate of 1 ton per acre. No other part of the field was limed.

A number of soil samples were taken throughout the field and the hydrogen-ion concentrations of these have since been measured. The results are shown in Fig. 8.

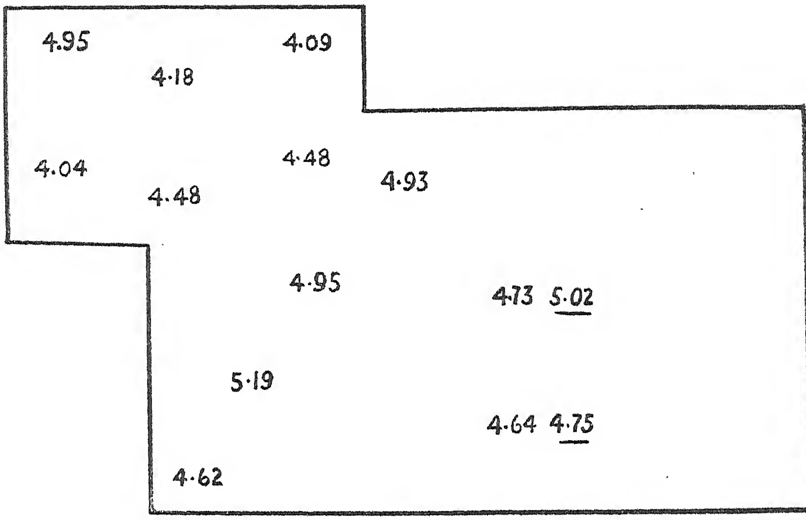


Fig. 8.—Showing hydrogen-ion concentration of soil at different parts of the Beet Crop at Borrmount.

These results show that the field at Borrmount is unduly acid, particularly for a crop such as beet. It will be noted moreover that the most acid samples were taken from the top left-hand corner of the field where the crop was a complete failure. The figures underlined in the diagram were taken from the limed portion of the field, the application having been given at the rate of 1 ton per acre. It is evident that the application of this quantity of lime is quite inadequate. We will revert to the question of lime requirement when the results from a few more farms have been dealt with.

On November 28th one of the Department's Inspectors furnished me with further soil samples from three beet crops in Co. Wexford, together with a report on the crops from which the samples were taken.

The first batch of these were from the farm of Mr. P. Kehoe, Glencarrig, Co. Wexford. The crop in this case appeared in good condition until the date of singling. Then strips and spots began to "stag." In November the crop presented "a striking and unusual appearance of partial failure. There were strips and clumps of beet interspersed with under-developed plants apparently in all stages of growth but showing no sign of disease The failures could not be correlated with anything apparent to the eye."

The samples from this crop consisted of one from where the crop was really bad and a further one from among a patch of very good beet some distance away. The former showed a hydrogen-ion concentration of pH 5.00, and the latter, pH 5.55. If the differences in the beet crop in this case be due to differences in soil acidity it is important to note that a sample taken from the stubble ground set aside for the 1929 beet crop on this farm shows a hydrogen-ion concentration of pH 4.86, which is more acid still than the sample above referred to on which the crop has failed in the present year.

The second batch of samples were from the farm of Mr. J. Furlong,

Knockreigh, Adamstown, Enniscorthy. In this case the crop is stated to have looked well, though rather patchy, until it was lifted. The roots were then revealed as small, badly shaped and rather fangy. One of the Department's trials had been laid down at this centre and sub-plots dressed with (a) nitro-chalk and (b) 2 tons of ground lime per acre, in addition to standard manuring, produced yields considerably in excess of the sub-plots which received no lime. The roots were also comparatively free from fangs.

The soil sample from the unlimed plot had a hydrogen-ion concentration of pH *4.33*, the corresponding sub-soil being pH 4.47; while the surface soil from the plot which had received 2 tons of ground lime per statute acre showed an acidity of pH *4.71*, the corresponding sub-soil being pH 4.98. It will be observed that the soil of the standard plot shows an acidity as great as the region of complete failure at Borrmount, while the influence of two tons of lime on an acre of soil is unexpectedly small. If one is to judge by these samples the lime was able to penetrate a very acid surface soil and effect an approximately equal degree of neutralisation in the sub-soil.

Stubble ground intended for the 1929 beet crop on Mr. Furlong's farm shows a reaction of pH 4.86.

The other samples examined were taken from the farm of Mr. George Warren, Clonhenret, Gorey, Co. Wexford.

This crop contained a big proportion of very large 8 lb. beet. All roots were mis-shapen and coarse. Portion of the crop not harvested had very coarse tops and showed many gaps and quite a big proportion of huge roots. On other fields this grower had bad failures with beet and consequently this field was manured heavily (20-25 tons of farmyard manure and 12 cwt. of artificials per statute acre). The soil is a very friable heavy loam in regular rotation, and apparently this is a case where an unsuitable soil has been made productive by heavy manuring, but the crop produced was quite abnormal.

Chemical examination of this soil reveals the fact that it is unusually ferruginous. Samples taken from where abnormal roots are produced show approximately the same acidity as where the roots are stated to be not so large, the hydrogen-ion concentration in the former case being pH 5.12 and in the latter pH 5.19.

[TABLE.

General Conclusions on the Wexford Failures.

A resumé of the acidities of the Wexford soils examined is given in the following table:

TABLE 5.

Soil No.	Location.	Nature of Crop.	pH of Surface.	Subsoil No.	pH. of Subsoil.
Wx. 1	Middle of limed plot at Borrmount.	Rather poor ...	5·02	—	—
Wx. 2	From unlimed plot, near Wx. 1.	Somewhat poorer than Wx. 1.	4·73	—	—
Wx. 3	Lower end of limed plot at Borrmount.	Fairly good ...	4·75	—	—
Wx. 4	From unlimed plot near Wx. 3.	Fair crop, not so good as Wx. 3.	4·64	—	—
Wx. 7	Ferny Field, Borrmount	Complete failure ...	4·59	Wx. 8	4·33
Wx. 9	Do. ...	do. ...	4·04	—	—
Wx. 10	Do. ...	do. ...	4·48	Wx. 11	4·48
Wx. 12	Do. ...	do. ...	4·18	Wx. 13	4·33
Wx. 14	Do. ...	do. ...	4·09	—	—
Wx. 15	Do.	do. ...	4·48	—	—
Wx. 5	From successful crop near Ferny Field.	Medium quality ...	4·95	Wx. 6	4·79
Wx. 22	Dunsinane	Good crop ...	4·92	—	—
Wx. 23	Do.	Failure ...	4·92	Wx. 24	4·92
Wx. 25	Glencarrig	Very poor ...	5·00	Wx. 26	5·52
Wx. 27	Do.	Quite good ...	5·55	Wx. 28	5·88
Wx. 36	Clonhenret	Abnormal roots ...	5·12	Wx. 37	5·36
Wx. 38	Do.	Roots not so large	5·19	Wx. 39	5·19
Wx. 34	Standard plot at Knockreigh.	Small fangy roots	4·33	Wx. 35	4·47
Wx. 32	Limed plot at Knockreigh.	Crop much better than at Wx. 34.	4·71	Wx. 33	4·98

Beet is a crop which is universally regarded as having a relatively high lime requirement. Continental experience would seem to indicate that it is a crop which gives maximum growth in a soil which is nearly neutral, the soil reaction regarded as most desirable for beet being about pH 6.5. The County Wexford soils above-mentioned show reactions which would certainly be looked upon as most unfavourable to a crop such as beet. In some cases they approach the extreme limit of acidity which one is likely to find in any soil, because a soil reaction less than pH 4.0 is relatively rare. The conclusion, therefore, seems justified that the prime need of these soils for beet cultivation is the application of lime. In this connexion it is to be noted that on the two farms where lime was applied this year, increased yields and better quality beets resulted, although in each case it is evident that the amount of lime applied was insufficient.

Reference may be made in passing to some results ascertained by the late George Newlands and published in the October (1928) number of the "Journal of Agricultural Science," in which it is stated that in the north-east of Scotland when the soil was below pH 5.3, the growth of beet was either poor or failed. Above this figure growth was stated to be relatively good.

These seems extremely little room for doubt that a fairly close relationship exists between the growth of a crop such as beet and the hydrogen-ion concentration of the soil, but since hydrogen-ion concentration is only one of a number of variable factors concerned in plant growth it would be unreasonable to expect this relationship to hold in a rigidly uniform manner under all soil conditions. It is, however, very likely that under what may be termed average soil conditions there exists a particular hydrogen-ion concentration at which beet will show maximum yield and quality. The aim in liming acid soils should be to bring the soil to approximately this value. Without insisting further on this point pending the opportunity for further investigation it may be mentioned that the best beet met with in the course of the present survey grew in soil of pH 6.0.

On the other hand, one cannot dogmatically lay down the rule that beet will not grow tolerably well at, say, pH 5.0 or even at pH 4.5. While failure was recorded at Glencarrig at the former value, tolerably good beets were found in one place at Borrmount in soil as low as pH 4.6. At the same time there were failures at Borrmount at pH 4.9.

The important conclusion to be drawn from the data here collected on the growth of beet in acid soils is that the farmer who attempts to grow beet in soil in the region of pH 5 or under is taking serious risk. The same conclusion applies to the growth of beet on soil more alkaline than pH 8. Between the values of pH 5.3 and pH 7.8 there lies a safety region, with the probability of most satisfactory results about pH 6.5.

Observations on some soils for Beet in Co. Wexford in 1929.

A number of samples of Co. Wexford soils intended for beet production in the 1929 season were examined in the course of the present investigation. The results are tabulated below. The beet crop on all of these soils should derive benefit from liming.

TABLE 6.

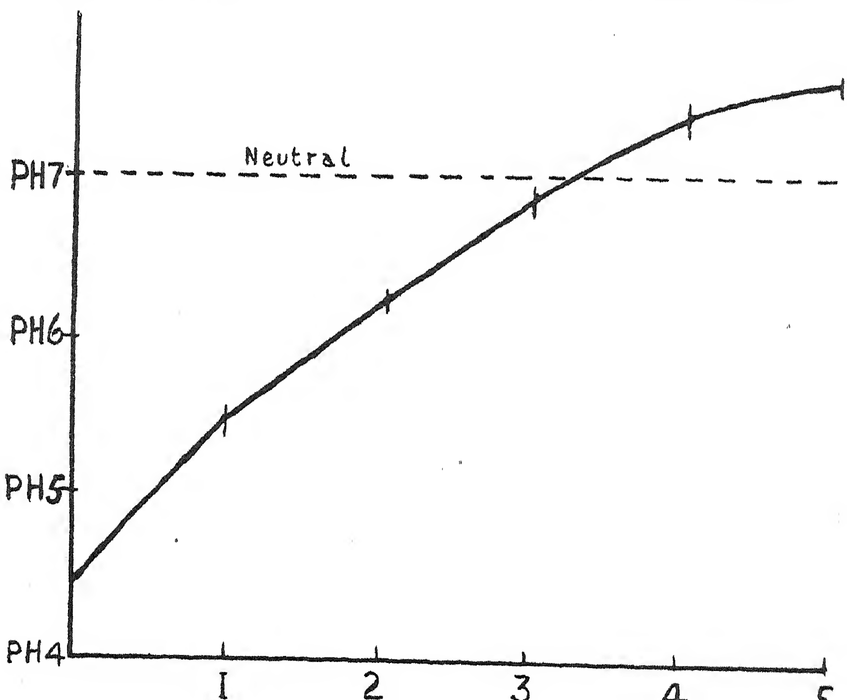
Soil No.	Location.	pH. of surface (9″).	Sub-soil No.	pH. of Sub-soil.
—	"Ferny Field," Borrmount. (See Wx. 7—Wx. 15 in Previous Table.	4·04—4·95	—	—
Wx. 16	"Long Field," Borrmount	4·95	—	—
Wx. 17	Do.	5·19	—	—
Wx. 18	Do.	4·62	—	—
Wx. 19	"Nine Acre" field, Borrmount ...	5·32	—	—
Wx. 20	Do.	5·78	—	—
Wx. 21	Do.	5·04	—	—
Wx. 29	Stubble for beet, P. Kehoe, Glencarrig ...	4·86	Wx. 30	5·21
Wx. 21	Stubble for beet, Th. Furlong, Knockreigh	4·86	—	—

In the concluding section of this Report some observations are added on the quantitative lime requirement of these soils.

The Lime-requirement of the Stubble for Beet at Borrmount, Co. Wexford.

The quantitative determination of lime requirement presents a certain degree of difficulty. As is often the case in a difficult analytical problem the number of different analytical methods available is almost unlimited. The most promising and rational method is that which seeks an estimate of the quantity of lime necessary to bring an acid soil to any desired hydrogen-ion concentration. This method is in considerable use by many soil investigators, the ordinary procedure being to shake the soil with varying quantities of lime water for about an hour and then deduce results from the resulting titration curve. In the course of an investigation carried out by the author last year it was found that this procedure leads to entirely unreliable results for the simple reason that the absorption of lime by the soil is incomplete after one hour or even after one day. A minimum period of contact of a week was found necessary before substantially constant results could be obtained.

In order to furnish a guide to the liming of the 1929 crop at Borrmount a compost of a couple of samples from the " Ferny Field " at that farm was treated with lime water for one week. The effect of lime on the pH of the soil in question is shown in the accompanying curve, the results being given in terms of tons of burnt lime per acre-foot of 2,000,000 lbs.



Tons of burnt lime per acre-foot.

Fig. 9.

The curve shown (Fig. .9) indicates that if quicklime were incorporated in the surface soil to a depth of 1 foot an application of about $3\frac{1}{2}$ tons would be required to bring the reaction from pH 4.5 to neutrality (pH 7.0),

while if we were again to judge from this curve, an application of quicklime at the rate of one ton per acre should be capable of bringing the surface soil from pH 4.5 to pH 5.5.

We know, however, from tests already carried out on the limed and unlimed plots in this year's beet crop on the same farm that no such result is likely to be attained in practice, at least at the end of the season. For instance, a surface sample taken from the limed plot which had received 1 ton of ground lime per acre showed a reaction of pH 5.02, while a sample from continguous unlimed ground showed pH 4.73. More striking still were a second set of contiguous samples from different parts of the same plots in which case the limed portion was pH 4.75 and the unlimed pH 4.64.

These divergencies from the theoretical or titration results undoubtedly require explanation, and in this respect the following points need to be considered. To begin with, it is unwise to attach too much importance to a liming trial in which no analytical data are available as to the quality of the lime used. Secondly, a considerable quantity of the lime applied probably percolated to the sub-soil before it could be absorbed by the surface. At Knockreigh, for instance, where a trial was carried out with two tons of ground lime per acre the surface soil showed an increase over the standard plot of 0.38 pH units, while the sub-soil showed an increase of 0.51 pH units. In recent liming trials in Berkshire the loss of lime from the surface soil is reckoned at the average rate of 10 cwts. of $CaCO_3$ per acre, per annum.

Taking these matters into consideration it will be apparent that an estimate of four tons of quicklime per acre should not prove excessive for a beet crop in the "Ferny Field" at Bormount. As a result of such an application the hydrogen-ion concentration of the soil of this field would probably not exceed pH 6 at the end of the season. An application of about three tons per acre might suffice in the case of the "Long Field" and about two tons per acre in the case of the "Nine Acre" field.

Sufficient time has not yet been available to arrive at similar estimates in the case of the other Wexford samples at hand, but relatively heavy liming is certainly advisable in the case of these soils for the proper cultivation of beet. The soil on the farm of Mr. Somers at Dunsinane, however, is lighter and more sandy than the others examined, so that in spite of its acidity a more moderate application of lime should give good results. The question is being further investigated.

There remains one further conclusion to be derived from the results of this investigation. *The use of lime in preparation for the beet crop clearly demands discretion based on a knowledge of local soil conditions.* The application of lime to neutral or alkaline soils is definitely dangerous in so far as it will favour an attack of the crop by heart-rot or phoma. On the other hand, *soils which really require liming are those which are excessively acid* and consequently difficult to neutralise or render alkaline. Under conditions, therefore, where a soil can definitely be said to be in need of lime, the danger of inducing heart-rot by ordinary practical applications of this substance is essentially remote.

THE GROWING OF OATS ON PEATY SOIL.

By N. P. Cotter, A.R.C.Sc.I., *Agricultural Instructor, Co. Roscommon.*

In many districts in Co. Roscommon the growing of a successful crop of oats on reclaimed peaty land has hitherto been attended with much difficulty and in many cases with almost complete failure. In one particular area in the neighbourhood of Athlone the failure of the crop became so general that large numbers of farmers no longer included oats in the rotation. Although "lodging" when in ear seemed to have been the chief cause of complaint, there were numerous cases where the crop failed at a much earlier stage of its growth, where, in fact, the braird appeared quite healthy for about a month or six weeks after coming over ground and then suddenly became yellow and died off almost completely.

The problem thus presented to small farmers, the greater part of whose holdings consisted of reclaimed peaty land, was serious in the extreme. To such farmers the oat crop is nearly as important as is the potato crop, particularly when, as in the district referred to, the custom was to have portion of the crop converted into oatmeal for use in the home. That the small holders concerned made determined efforts to grow a crop of oats at any cost is well demonstrated by the custom which prevailed among the older generation. What was known as a fallow system was adopted. After being rested for a year or more in grass the skin was stripped off the land and in early spring put up in clamps similar to turf and burned when dry; the resultant ashes were then spread over the bare fallow. The seed was sown generally from the beginning to the middle of May. Furrows were then dug about ten to twelve yards apart and the soil shovelled over the plots to cover the seed. It is stated that where this system was adopted oats grew successfully without showing yellowing of the braird during the early stages of growth, and the success of the practice would seem to suggest that potash was an essential to successful growth.

With the object of obtaining information regarding the effects of the application of manures to oats grown on peaty soils and also to compare the standing power of different varieties of oats, a preliminary test was made in 1926 and in the two succeeding years manurial experiments were conducted. The land selected was in every case that on which the oat crop was known to have been a failure in previous seasons.

The results of the preliminary tests appeared to indicate that :—

(1) Potato oats, the variety hitherto generally sown in the district, was more affected with yellowing on peaty soil deficient in lime and potash than were strong strawed varieties, and that this variety was unsuitable owing to its tendency to produce an excess of straw and to lodge long before the grain fills or ripens on such soils.

(2) The addition of lime or potash, or both, to peaty soils produced a braird which had a healthy green appearance from the beginning and showed no sign of yellowing.

(3) Certain strong strawed varieties gave much better results and stood better than potato oats. They also produced grain of good quality when lime, potash and phosphates were applied before or at the time of sowing.

Further investigations were carried out in 1927 in order to ascertain the effect of different manures on peaty soils. In that year only one variety of oats, Victory II., was grown on the plots which were laid down as follows:—

Series (A).	Series (B).
Plot 1. Lime.	Plot 1. No. Lime.
„ 2. Lime. 5 cwts. Kainit.	„ 2.—No Lime. 5 cwts. Kainit.
„ 3. Lime. 5 cwts. Kainit. 3 cwts. Superphosphate	„ 3. No Lime. 5 cwts. Kainit. 3 cwts. Superphosphate.
„ 4. Lime. 5 cwts. Kainit. 3 cwts. Superphosphate. 1 cwt. Sulphate Ammonia.	„ 4. No Lime 5 cwts. Kainit. 3 cwts. Superphosphate. 1 cwt. Sulphate Ammonia.

Lime was applied at the rate of about 2 tons per acre to the plots in Series (A) in November, 1926, after the ground was ploughed.

All the plots were sown on 11th April, 1927. The seed germinated evenly and produced crops which appeared healthy, until about the 30th May. After that date a distinct difference was observed in favour of the appearance of the limed plots. The braird on the unlimed plots did not in contrast look so healthy, and this difference in appearance continued until the time of harvesting. The plots were harvested separately and the yields of straw and grain per statute acre estimated as follows:—

Limed.			Not Limed.		
	Grain.	Straw.		Grain.	Straw.
Plot 1.	15½ cwts.	34 cwts.	Plot 1.	9¾ cwts.	23 cwts.
„ 2.	18¾ „	37 „	„ 2.	13½ „	31 „
„ 3.	21 „	38 „	„ 3.	15¾ „	35 „
„ 4.	21½ „	42 „	„ 4.	14½ „	37 „

The grain produced on Plots 1 in each series was not well filled, but this was more evident in the plot which received no lime. On Plot 1, Series (B), a large percentage of the grain was huskey, small and light. It should be mentioned that the yellowing of the braird was not very evident in the case of Victory II. even on the worst plots, but the straw on the latter was

very brittle. The addition of kainit in every case resulted in a higher yield of straw and a greater amount of grain which filled and ripened better than on the plots to which no kainit was applied. The straw on the potash plots also stood well. The addition of superphosphate still further increased the yield and improved the quality of both grain and straw. The plots to which the complete mixture containing sulphate of ammonia was applied produced longer straw and a greater yield than that on any of the other plots, but caution must be exercised in the use of a complete manure on this class of soil as it tends to produce an excessive growth of straw and subsequent lodging.

In 1928 experiments were conducted on three different farms where oats had been sown during previous years but had not been a success. The plan of the experiments was the same as in the previous year. The quantity of kainit applied was, however, reduced from 5 cwts. to 3 cwts. per acre; an additional plot being included which received 5 cwts. kainit per acre.

The plots were sown during the first half of April and the manures in each case were applied after the last harrowing at the time of sowing. The seed on all plots germinated uniformly and the brairds had a healthy appearance for about six weeks after coming over ground. The unlimed and unmanured plot at two of the centres then became sickly and began to show a distinct yellowing of the braird. By the end of June, this plot at each of the three centres had become very thin due to the failure of the braird which was badly affected with yellowing. During July it was quite easy to observe the difference that existed in the appearance of the plots. The application of lime and artificial manures resulted in every case in a marked improvement in the oats as compared with the unlimed and unmanured plots.

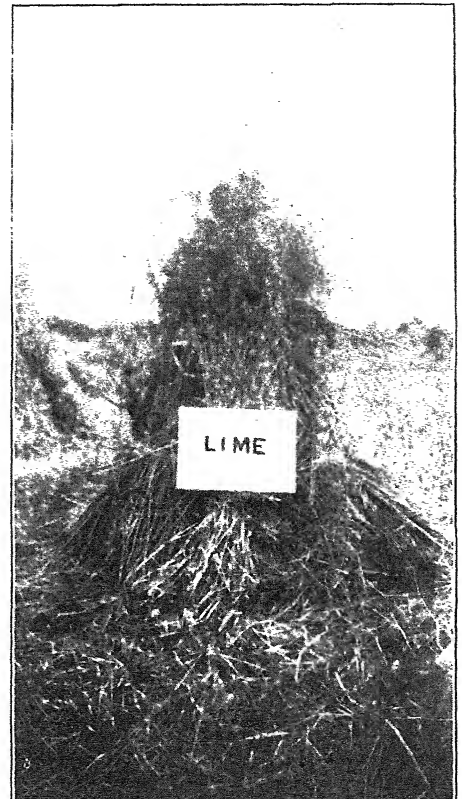
The following table gives the average yield of grain per statute acre from two of the experiments:—

	Limed. Grain.		Not Limed. Grain.	
	cwts.	qrs.	cwts.	qrs.
Plot 1. No Manure	10	1	7	2
„ 2. 3 cwts. Kainit	15	3	11	3
„ 3. 3 cwts. Kainit, 3 cwts. Superphosphate ...	20	3	14	1
„ 4. 3 cwts. Kainit, 3 cwts Superphosphate, 1 cwt. Sulphate Ammonia ...	27	0	18	0
„ 5. 5 cwts. Kainit	16	3	13	2

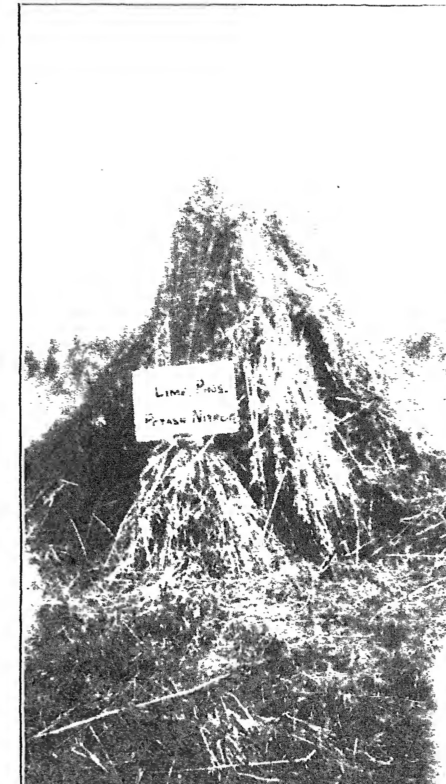
The yield of straw was not estimated from these plots owing to bad weather conditions which prevailed at the time of threshing.

During the harvesting of the crop the produce of a statute perch of each plot was photographed and the illustrations opposite will give some

No Lime or Manure.



Limed.



Limed and Dressed with Complete Manure.

General View of Crop after Harvesting.

impression of the results obtained. The photograph of the produce of the unlimed plot shows the brittle character of the straw as the result of lodging. The application of kainit had a very similar effect on the straw to that of lime and both these dressings produced stiff straw which stood well. The application of superphosphate resulted in well filled grain and more uniform ripening of the crop. The use of a complete manure, including sulphate of ammonia, although giving good results, produced an excessive growth of straw which, as previously mentioned, is very liable to cause lodging in bad weather. The inclusion of sulphate of ammonia or other nitrogenous fertilisers in the mixture for oats on such soils cannot, therefore, be recommended in every case. The illustration facing p. 85 which gives a general view of one of the fields after being harvested shows that the crop on the manured plotes was just as satisfactory as the average crop grown on upland. All these plots were, it may be added, laid down on peaty soil which was under cultivation with potatoes or roots for a number of successive years.

There is no doubt that oats can be grown satisfactorily on peaty soils of the type referred to, provided a suitable strong strawed variety is sown and a dressing of lime, superphosphate and kainit is applied.

Conclusions.

1. The application of lime in winter to peaty soils which have been cultivated and manured for a root crop for one or more seasons has a beneficial effect on the succeeding oat crop and tends towards the production of grain and straw of better quality. Yellowing of the oat braird is noticeably absent.

2. The application of kainit to the oat crop before or at the time of sowing appears to result in preventing yellowing of the braird. It promotes the production of better grain and stiffer straw and where lime was previously applied the results were very beneficial.

3. The use of a phosphatic manure with kainit on limed soils gave markedly improved results. An increased yield of both grain and straw was obtained and the quality of the grain was much improved.

4. The application of 5 cwts. kainit per statute acre did not influence the yield of grain and straw sufficiently to warrant recommending the use of more than 3 cwts. of this fertiliser per statute acre.

TESTS WITH WINTER SPRAYS FOR THE CONTROL OF RED MITE ON APPLE.

By J. Carroll, M.Sc., D.I.C., A.R.C.Sc.I., N.D.A., Agricultural Zoology Department, University College, Dublin.

Many owners of orchards will have noticed that the infestation of red mite (*Oligonychus ulmi*) on apples has increased very considerably since the advent of the tar-distillate sprays. As is well known, the tar-distillates, while being very efficient in killing the eggs of aphides and apple sucker, are inefficient in killing the eggs of the red mite.

The recent increase of red mite infestation can hardly be solely due to the fact that the winter eggs of the mite are not killed by the application of tar-distillate sprays. It has for some time been considered probable that these sprays kill off certain parasites, or predators (or both) of the mite, with the result that a biological check on the rapid increase of the mites during the following season is removed. Recently, Massee and Steer, of the East Malling Research Station, described a predaceous bug, *Anthocoris nemorum*, which they found feeding extensively on the red mite and its eggs. These workers consider it very likely that this bug (and others which they mention also) is either actually killed, whilst hibernating, by the tar-distillate sprays or is discouraged from remaining on trees which have been sprayed.

The desirability of discovering some efficient means of dealing with such a serious pest as red mite is obvious, and the great success of the tar-distillate sprays against aphides and sucker naturally makes one desirous of discovering some spray which will be equally efficient in killing the eggs of the red mite.

Research along these lines has been in progress during recent years in other countries, particularly in the United States. In the latter country it has been found that certain oil sprays, known as miscible oils, are very efficient in killing the winter eggs of the red mite. Emulsions of ordinary lubricating oils have also been found to be highly efficient in many cases. The miscible oils appear, however, to have given better and more constant results than the lubricating oil emulsions.

Different types of oil sprays, including lubricating oil emulsions, are the usual dormant washes in use in the United States. These sprays, however, possess the decided disadvantage that they are not efficient in killing the eggs of aphides and sucker and that fact alone would probably prevent their use becoming general in this country.

With the object of testing the efficiency of certain substances for killing the eggs of the red mite, the writer carried out a number of preliminary trials under laboratory conditions. This work was undertaken at the suggestion of Mr. G. O. Sherrard, lecturer in Horticulture, to whom the writer is greatly indebted for much useful advice. A miscible oil of the type used in the United States could not be obtained for the experiments, but a home-made lubricating oil emulsion was included among the materials tested. The mode of procedure was as follows:—Twigs heavily infested

with red mite eggs were cut from the trees in the orchard and brought into the laboratory. Suitable twigs were then set up in jars of culture solution and sprayed with the different materials under test, using an ordinary perfume spray bottle. The different twigs were then treated as will be described and finally the number of mites which hatched on each twig was counted.

The task of counting, with any degree of accuracy, the number of red mite eggs on a twig is so difficult that it has been undertaken by comparatively few workers. The eggs are small and are often deposited on the twigs and branches in such piled up masses as to make the task of counting, or even estimating the number present, almost impossible. The writer, not being aware of any good technique for counting the eggs, devised one which, although perhaps somewhat tedious, was quite satisfactory and given an average amount of care the error will probably not be more than about 5 per cent.

The eggs were counted immediately after the twigs had been cut from the trees. As far as possible light twigs, about one foot long, and on which the eggs appeared to be fairly evenly distributed, were selected. When a suitable twig had been chosen it was surveyed under a binocular microscope and any dense, piled up masses of eggs were brushed off with a stiff tooth brush. Eggs were also brushed out of cracks and crevices wherever it was thought it would be difficult to count them in such locations. Three or four inches of the stem of the twig were brushed clean before counting the eggs so that no eggs would remain on the part of the twig in the bottle. The eggs remaining on the twigs which had been brushed over with a tooth brush in this manner, were fairly well spread out, and not densely piled up at any point. Longitudinal slits were then made with a sharp scalpel through the egg masses remaining on the twig, and the eggs between each pair of slits were counted directly under the binocular microscope. The slits were made from about one-eighth to one-quarter of an inch apart, depending on the density of the egg masses and in no instance did the cutting of these longitudinal slits in the bark interfere with the subsequent growth of the twig.

Each twig, as soon as the eggs on it had been counted, was set up in a darkened, wide-mouth bottle (bottles of about 4 oz. capacity were used), the following procedure being adopted:—A stout cardboard disc sufficiently large to cover the mouth of the bottle was cut and a hole was bored in the centre of the disc through which the stem of the twig was pushed. When the twig had been inserted through the hole in the disc, some plasticine was packed around it to keep it firm in a vertical position and also to insure that no mites would crawl down through the hole later on. A ring of vaseline was then put on the upper side of the disc, about one inch out from the twig. The twigs when set up in the bottles as described were sprayed with the different materials under test. The spraying was done during the second week in February. A culture solution was used in the bottle containers. About once a week the solution was renewed and the twigs themselves sprayed with water. All the twigs used in the experiment remained alive and in the early spring came into full foliage and also blossomed.

The first mites commenced to hatch out about March 29th, by which time the twigs had already come into leaf. Hatching proceeded rapidly during the following week. The newly hatched mites quickly migrated either on to the leaves or off the twig altogether. Those which migrated off the twig were caught in the ring of vaseline. On April 19th (3 weeks after hatching commenced) it was assumed that hatching was complete and the task of counting the mites was begun.

The twigs were removed from the cardboard discs. The mites trapped round the edge of the vaseline ring were first counted under the binocular microscope, a fine needle being used to bury the mites one by one in the vaseline as they were counted. The counting of the mites on the twig itself presented a little more difficulty and was done in the following manner:—The leaves and the scales around the bases of the blossoms were cut off one by one into an evaporating basin containing 90 per cent. spirit. The leaves and scales were then taken individually with a forceps and all the mites on them were brushed off into the spirit with a camel-hair brush. When the mites settled to the bottom of the basin the bulk of the liquid was decanted off. The remainder was then filtered through a filter paper which had been previously ruled with parallel lines about one-sixth of an inch apart. The mites on the filter paper were then counted under the binocular microscope. There was a complete absence of dirt or sediment of any kind and no difficulty was experienced in the counting. The twig itself was then cut up into short lengths and each length was brushed down in 90 per cent. spirit with a camel-hair brush, and the mites counted in a similar manner. Generally, it was found that very few mites remained on the stem of the twig; in fact the number on it could have been disregarded, and thus a great amount of labour saved, without influencing appreciably the results of the experiment.

The details of the sprays used and the results of the experiment are given in the following Table:—

—	Percentage Strength.	Number of Viable Eggs on Twigs.	Total Number of Mites hatched.	Percentage of Eggs which hatched.
Control (*a*)	—	765	355	46·4
„ (*b*)	—	619	310	50·0
„ (*c*)	—	814	450	53·5
Tar-distillate (Drummond's)...	7½	840	310	37·0
„ „ ...	7½	468	121	25·8
„ „ ...	10	920	197	21·4
Volck	1½	954	155	16·2
„	2	1,268	103	8·1
„	3	890	76	8·5
Redolem (Red Oil Emulsion) ...	3	1,054	110	10·4
Lubricating Oil Emulsion ...	2 (actual oil content).	1,420	101	7·1
„ „	3 (actual oil content).	1,535	90	5·8
„ „	4 (actual oil content).	1,794	162	9·0
Methyl Salicylate in Soap Solution	½	1,403	650	46·3
„ „	1	931	170	18·2

The most conspicuous fact emerging from the results of the experiment is that on the control twigs only about 50 per cent. of the total number of eggs hatched. It is possible that the hatch would have been greater under natural out-of-door conditions.

It will be observed that although some eggs appear to have been killed by the tar-distillate spray, yet this did not give an efficient measure of control. "Volck," lubricating oil emulsion and "Redolem" gave a good control, but even with these the percentage hatch is higher than one would wish.

The experiment shows that it is possible to effect a large measure of control of the red mite by the application of dormant sprays, but no definite recommendation can as yet be made. It would be most desirable to discover a spray which would be equally efficient against aphides and sucker as well as against the red mite. Owing to the almost complete absence of aphid and sucker eggs from the twigs used in the experiment, the writer cannot make any statement as to the effect on them of any of the materials tested. It is hoped to carry out a much more comprehensive series of experiments next season under both laboratory and orchard conditions.

The infestation of red mite in the orchard of the Albert College was very serious last summer, with the result that winter eggs were deposited on the trees in great abundance. For the purpose of killing these winter eggs most of the trees in the orchard were sprayed last winter (about the end of November) with a 3 per cent. "Volck" spray. The trees were also sprayed with "Carbokrimp," in some cases the "Carbokrimp" being applied before the "Volck" and in other cases after it. A few trees were left as controls. In the spring of the present year the unsprayed trees were found to be badly infested with mite. Although some mites were also to be found on the trees which had been sprayed with "Volck," yet it was seen that on the majority of these the bulk of the eggs had failed to hatch. The percentage hatch cannot be stated but it appeared to approximate closely to the figure obtained in the laboratory tests. A few of the trees were an exception, the mite infestation on them appearing to be as bad as on the control trees. This, however, can very probably be accounted for by the fact that rain fell very soon after these trees had been sprayed.

Although "Volck" seems to have given a satisfactory result, yet it is desirable to find an even more efficient and much less expensive spray, and further research is necessary to achieve this object.

Summary.

1. The inefficiency of the tar-distillate sprays in controlling the red mite on apples, which is rapidly becoming a very serious orchard pest, has been pointed out.
2. A technique for counting, with a great degree of accuracy, the number of red mite eggs on twigs has been devised and is described in this paper. The method of counting the number of mites which hatched out on sprayed twigs (kept in jars of culture solution in the laboratory) is also described.

3. Tests, carried out under laboratory conditions, with different winter sprays, indicate that the oil sprays tested possess marked ovicidal properties.
4. The use of " Volck " as a winter spray gave a very good control of red mite in the orchard.

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A PROMISING NEW OAT: GLASNEVIN SONAS.

(*Produced at the Albert Agricultural College, Glasnevin.*)

By M. Caffrey, A.R.C.Sc.I (Lecturer in Plant Breeding, University College, Dublin).

There is at present a demand from farmers in all countries for varieties of wheat, oats and barley possessing stronger straw than those at present in general cultivation. This demand is especially insistent in this country, because the climatic conditions obtaining here favour the production of a soft, luscious vegetative growth, which, in the case of the cereals referred to is very easily lodged at harvest. Extensive lodging of corn crops occurs throughout the Saorstát every year with monotonous regularity; and in years when there is a heavy rainfall during the ripening period (as for instance in 1924 and 1926), it is not uncommon to see the corn in field after field completely " laid " over wide areas.

A badly lodged crop is rarely productive and is never economic, for under present conditions the cost of harvesting such a crop is prohibitive. Moreover the quality of the grain and straw is at best much depreciated. It is not therefore to be wondered at that, in the absence of suitable varieties of corn crops capable of withstanding lodging, owners of fertile soils are reluctant to engage in a tillage rotation in which cereals would of necessity have an important place. Furthermore, the lack of such varieties constitutes a deterrent to those farmers who would be prepared, under different circumstances, to use—to much greater extent than is safe at present—the many valuable natural and artificial fertilizers now available with a view to increasing the returns from their soils.

Within recent years some attention has been paid to the production of strong strawed varieties of wheat; notably at the School of Agriculture, Cambridge, and at the Plant Breeding Institute at Svalöf, Sweden; but no investigational work on a scale comparable to that carried out in the case of wheat has been done with a view to the production of strong strawed varieties of oats and barley, although it is quite clear that the production of prolific strong strawed varieties of these cereals would be of the utmost economic importance to farmers in Northern Europe and America. The Seed Propagation Division of the Department of Agriculture has however given considerable attention to this important matter and has produced strong strawed varieties of both oats and barley suited for cultivation in Ireland. It is here proposed to refer particularly to the production by the above Division of a new prolific oat variety which has been proved to possess stronger straw, than any other oat variety in general cultivation in this country.

In the early years of its existence the Seed Propagation Division confined its efforts to secure stronger strawed oats to the selection of single plants from commercial stocks of the most valuable varieties suited for cultivation in Ireland, and the propagation of the plants so selected which combined

best the desirable qualities of yield and resistance to lodging. When the best available strains of the leading varieties had been isolated and propagated, resort was had to crossing between these strains with a view to obtaining new forms combining in a greater degree than was possessed by the parental types, the capacities for high production and strong resistance to lodging. One of the crosses made was between a pedigree strain of Banner and a pedigree strain of Black Tartary, and from that crossing a variety provisonally named " Banner-Tartary 9 " and now renamed " Glasnevin Sonas " has been derived. This particular cross was made in 1911.

It is theoretically possible to obtain new varietal types breeding true from a crossing between varieties of a particular plant species as early as the second filial generation following that particular cross, but generally several years elapse before pure breeding forms are secured. The method of improvement adopted by the Seed Propagation Division in dealing with the progenies of hybrids is to make single plant selections from such progenies, to grow the seed from each selected plant in pure culture, to discard all cultures which on cultivation prove inferior, and to continue to make selections from the successive progenies of the best forms until pure breeding types are secured. In the case of the hybrids resulting from the above-mentioned Banner-Black Tartary cross, selection had to be continued for many years and it was not found feasible until 1919 to proceed to the propagation in small field plots of two promising forms—Banner-Tartary 2 and Banner-Tartary 4. A third form, that now renamed Glasnevin Sonas, was not sufficiently pure at this stage for propagation and was not grown in a field plot until 1921. At that time Banner-Tartary 2 and and Banner-Tartary 4 were considered to be the most promising derivities from the Banner-Black Tartary cross, but in subsequent field trials they did not confirm their early promise and both have now been discarded.

Glasnevin Sonas was first tested in the field quantitative trials, carried out annually at the Albert Agricultural College, during the season 1923 and yielded so well as to justify its inclusion in trials conducted on the College farm in subsequent years. The results of the experiments carried out during three years 1923-1925 in which Glasnevin Sonas was tested with Victory, Victory 2 and Banner are set out in the following Table:—

	Yield of Dressed Grain.						Average Yield of Dressed Grain. 1923-25	
	1923		1924		1925			
	*Brls.	sts.	*Brls.	sts.	*Brls.	sts.	*Brls.	sts.
Glasnevin Sonas ...	15	4	23	3	18	8	19	0
Victory 2 ...	15	4	19	4	15	12	16	8
Victory ...	15	2	20	3	16	12	17	6
Banner ...	13	12	19	7	16	4	16	6

*1 Barrel is equal to 14 stones.

HARVESTING CROP OF "GLASNEVIN SONAS"
(Albert Agricultural College, 1929).

HARVESTING BADLY LODGED CROP OF VICTORY OATS
(Albert Agricultural College, 1929).

Glasnevin Sonas stood perfectly in 1923 and 1925. In 1924, which was one of the wettest seasons experienced in Ireland for several years, 40% of the crop of this variety lodged immediately before harvest. In the same year it was estimated that 80% of the remaining three varieties under test were lodged at harvest and moreover lodging had occurred at a very early stage of ripening.

The result of the three years quantitative variety experiments at the Albert Agricultural College, justified trials on a wide scale throughout the country with Glasnevin Sonas, and accordingly in the spring of 1926 the following series of experiments were arranged :—(*a*) Large scale quantitative trials with this variety on very rich land in Counties Meath, Limerick, Dublin and Kildare, where oats are not generally produced owing to the extensive lodging which takes place when the ordinary commercial varieties are grown; (*b*) large scale quantitative trials in districts where, though the soil is fertile, oats are grown as a rotation crop; (*c*) small scale quantitative trials carried out throughout the country by the Agricultural Instructors. These latter trials have been continued for the past three seasons.

In the large scale quantitative trials, which were conducted at ten centres, Glasnevin Sonas stood up perfectly and yielded well at seven centres, at two centres it was estimated that 10% of the crop was "laid" at harvest and at one centre (Co. Limerick) 75% of the crop was lodged by the rainstorm which occurred on 18th July, 1926.

In the large scale quantitative trials which were conducted at eight centres, Glasnevin Sonas and another hybrid variety, Victory-Mogul 4/3/2 (which was also raised by the Seed Propagation Division on the Albert Agricultural College farm), were tested at each centre against the commercial variety which previous experience had shown was well suited for cultivation at that centre. This was considered a very severe test for Glasnevin Sonas. It is well known that many varieties of oats are restricted as regards habitat, and it was not reasonably to be expected that any particular variety would compare favourably at all centres, which designedly covered a wide range as regards soil and climate, with the variety which had proved to be specially suited for cultivation at each particular centre.

[TABLE.

The results of these Experiments are set out in the following Table:—

	Glasnevin Sonas.		Victory-Mogul 4/3/2		Commercial Variety.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	Brls. st.	Cwt. st.	Brls. st.	Cwt. st.	Brls. st.	Cwt. st.
Agricultural College, Warrenstown, Co. Meath ...	13 3	35 2	9 4	28 0	12 8 (Record)	36 4
Agricultural School, Ballyhaise, Co. Cavan ...	16 4	35 0	14 4	31 3	15 6 (Superb)	34 0
Lord Holmpatrick, Abbotstown Castleknock Co. Dublin	19 6	62 4	17 10	58 2	13 2 (Yielder)	—
J. J. Rea, Ballindangan, Co. Cork	13 10	41 4	12 10	39 2	13 0 (Potato)	38 1
W. Longworth, Ballymone, Moate, Co. Westmeath ...	12 4	32 1	13 4	33 2	11 2 (Victory 2)	29 2
P. Power, Callan, Co. Kilkenny	18 8	46 4	14 5	48 0	14 2 (Victory)	42 0
Mount St. Joseph's College, Roscrea, Co. Tipperary ...	17 4	57 0	15 9	56 0	12 12 (Victory)	41 0
Copsewood College, Pallaskenry, Co. Limerick ...	19 6	56 0	16 4	44 0	18 4 (Victory)	36 0
Average	16 4	45 6	14 3	42 2		

Glasnevin Sonas, as will be observed, was superior to the commercial variety at each of the eight centres. It was moreover superior to Victory-Mogul 4/3/2 at seven of the eight centres, the average increased return of grain and straw over the latter variety being two barrels and two stones and three cwts. and four stones, respectively.

The quantiative experiments with Glasnevin Sonas inaugurated in 1926 under the supervision of the Agricultural Instructors have been carried out at several centres during the three seasons, 1926, '27 and '28, and the results of these experiments in respect of yield of grain and straw are set out in the following Table:—

Variety.	1926 (28 centres).		1927 (24 centres).		1928 (22 centres).	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	Cwt. st.	Cwt. st.	Cwt. st.	Cwt. st.	Cwt. st.	Cwt. st.
Glasnevin Sonas	25 0	35 3	24 1	37 0	22 2	37 0
Victory 2	24 2	36 0	23 3	37 0	23 3	36 3
Victory	23 3	34 3	22 2	36 0	—	—
Crown	24 1	34 2	23 3	37 0	—	—

It will be noted that on the average of the three years' trials carried out throughout the country under the supervision of Agricultural Instructors, Glasnevin Sonas has proved to be practically equal to Victory 2 which had hitherto proved to be the most prolific variety in general cultivation in Saorstát Eireann. One feature of the results which was brought out by a detailed examination of the results from the individual trials was that Glasnevin Sonas was superior in yield to Victory 2 at those centres where the soil was above the average in fertility, whereas Victory 2 was the more prolific variety on poor and average soils. It would, therefore, be desirable for farmers to reserve Glasnevin Sonas for cultivation on fertile soils, and to sow Victory and Victory 2 on soils of lesser fertility. It was evident from the reports of the Agricultural Instructors that Glasnevin Sonas proved to be much superior to Victory or Victory 2 in strength of straw.

Glasnevin Sonas has not so far been tested to a wide extent outside Ireland. It was, however, tested in 1928 with nine other well-known leading varieties at the University College, Bangor. The following is an extract from the Report published by the University College of North Wales, entitled "Oat Variety Trials, 1927 and 1928":—"Banner Tartary 9* which was introduced mostly on its reputation from the Irish trials of being exceptionally strong strawed proved to be the strongest in the straw in each of the three series. Each series contained three plots of this variety so as to give it a thorough test in this respect and only in one plot was this variety badly laid. No variety has been found which can stand up in all weathers at Aber, but this variety in 1928 was superior to the others." Moreover as regards yield of grain it proved to be very satisfactory, but of course little significance can be attached to results from a single centre for only one year.

This new variety has however certain limitations. It ripens very late, about a week later than Victory, and for this reason it should be sown as early as possible. Moreover it grows very slowly up to the heading stage. It can easily be recognised previous to this stage owing to the very dark green colour of the foliage and the erect manner in which the leaves are borne or carried. The grain is generally of a deeper yellowish colour than that of Victory, it is smaller than the latter variety, and there is generally a large quantity of "seconds." It is not, in short, a variety which as regards size or colour of grain would appeal to a seed-merchant. Its main appeal is to the farmer desirous of obtaining a variety which is likely to stand up and yield well on heavy land.

In respect of grain quality as measured by the proportion of kernel to husk, well filled samples of Glasnevin Sonas compare favourably with many of the leading commercial varieties. Determinations of the percentages of husk and of kernel and of the weights of 1,000 corns were made on well dressed samples of Victory 2, Glasnevin Sonas, Record and Potato grown on contiguous plots on manured ground at the Albert Agricultural

* Since re-named "Glasnevin Sonas."

College during the past season and the results obtained are set out in the following Table:—

Variety.	Weight of 1,000 Corns.	Percentage of Kernel.	Percentage of Husk.
	grams.		
Potato	34·4	73·2	26·8
Glasnevin Sonas ...	42·6	73·1	26·9
Record	42·8	70·9	29·1
Victory 2	45·6	72·9	27·1

The differences between Potato, Glasnevin Sonas and Victory 2 are within the limits of experimental error. The comparatively high percentage of husk in Record is accounted for by the fact that that variety has invariably a higher proportion of infertile grains when grown at the Albert College than any other well-known commercial variety of oats.

Investigational work is being carried on by the Plant Breeding Department of the Agricultural Faculty of University College, Dublin, at the Albert College Farm, with a view to obtaining, if possible, improved forms of Glasnevin Sonas. With this aim in view, numerous selections have been made from the original stocks of this variety which were sent out to various parts of the country many years ago and which have done well. At the present time 15 selections are being tested. In addition Glasnevin Sonas has been crossed with Victory 2, Mansholt's 3, Record, and other leading varieties and promising forms derived from these separate crossings are now being propagated.

MID-SEASON FRUIT CROP REPORT, 1929.

Following a winter of unusual severity, culminating in a wave of almost Arctic weather which spread over the greater part of Northern Europe in February, the month of March opened out with a period of bright, warm, sunny days, which continued almost uninterruptedly until the end of April. The nights were, however, cold, with frequent ground frosts, and occasionally during these months the temperature in the daytime fell to very cold and any winds there were were harsh. May opened with showery weather and harsh winds, but towards the middle of the month the temperature became milder, with soft rains, and in the last week of that month warm sunshine, succeeding the rains, promoted rapid growth. The first three weeks of June were again unsettled, showers alternating with dull heat, varied by an occasional harsh day with night frosts; but from the beginning of the third week until well on in July warm sunny weather prevailed. The period from March to June, inclusive, was one of the driest on record. The plants made rapid growth and by the end of April were almost a fortnight earlier than on the corresponding date last year.

The harsh winds in mid-May caused much havoc in orchards, especially in Counties Clare, Meath, Galway, Kildare and Tipperary, and in some districts of Leix, Monaghan and Mayo. Many of the apple blossoms, especially those of Bramley's Seedling trees, were destroyed by frosts in the bud stage at this time. A storm early in May did considerable damage to young trees in County Leitrim, but the older trees did not suffer to anything like the same extent. This cold period retarded growth and marred the promise of an early harvest in those areas. In County Sligo and part of County Cork the weather was more favourable during the flowering period and the fruit set well; but the subsequent dry weather caused the fruit to fall off prematurely. This also occurred in many other districts in well sheltered orchards and gardens where the trees had set a very heavy crop of fruit.

Tree fruits on the whole do not promise very well, with the exception of cherries and pears on walls. Apples will probably produce a fair crop, but it is feared that plums, damsons and pears in the open will be much below the average.

Most of the bush trees, being intercropped among larger fruit trees, and thus more or less sheltered, were not so much affected by the adverse weather conditions at the flowering stage, and hence in the generality of cases they bore a very heavy crop of fruit which in almost every case finished well.

Bush and Small Fruits.

Gooseberries proved a very heavy crop this year, being even larger than last year, which had been one of the best obtained for a number of years. The fruits, however, though more numerous, were smaller, as owing to the lack of moisture during the growing period they did not fully develop, except in low-lying districts. This was particularly the case in Counties Dublin, Meath, Louth, Wicklow, Cork and Tipperary. Large supplies of

Early Amber, Whinham's Industry and Keepsake were marketed in Dublin and other centres, fetching prices only slightly lower than those of last season. In Dublin the very early green berries sold at prices ranging from 10d. to 6d. per lb. Later on the ripe fruit made 6s. 6d. to 2s. 9d. a float of from 12 to 18 lb., according to quality. In trays of 12 lb. they made from 3s. 3d. to 4s. In County Wicklow the prevailing price was 2s. per gallon; in County Sligo, 1s. 6d. to 4s. 6d. per stone, according to quality; in Counties Tipperary and Mayo, 4d. to 5d. per quart; in County Louth, 3s. to 4s. 6d. per stone, and in County Kildare 4d. to 6d. per lb. In County Limerick the price was 4d. to 8d. per pint; but in West Cork the supply was in excess of the demand.

Strawberries.—The year proved a good one for this fruit. The growth of foliage began early and consequently, except in the case of a few of the very early flowers which suffered from the frost, the flowers were well protected and the fruit set well, producing good crops of large, well coloured berries, especially for first and second pickings. Owing to the long-continued drought during the period of growth, the season, although somewhat earlier, did not last so long as usual. Very little, if any, damage was caused this year by slugs and snails, which it will be recalled were so destructive of the fruit last year; and little damage arose from mildew. Although the fruits in the last picking were on the small side, they were clean, well coloured, and free from blemish. Prices this year ruled lower than usual. In the Dublin market early selected fruits made 3s. 6d. per lb., but later in the season fell to 7d. per lb. In County Cavan the fruit sold at 1s. 7d.; in County Meath, 1s.; in County Cork, 1s. to 1s. 6d.; in County Galway, 1s. to 2s.; in County Mayo, 8d. to 1s. 6d.; in County Carlow, 1s. to 2s. 6d., and in Counties Limerick and Sligo 1s. to 3s. per lb.

The Laxton did well and is being planted in most cases by the market gardeners. Royal Sovereign and Leader also did well. A number of crates of Madam Kooi were sold in the Dublin market, but it was observed that the fruit did not appear to travel well.

Raspberries produced a very good crop of high quality fruit, almost all correspondents reporting a yield above the average. The plants flowered well and, except in a few cases where frost injured the earlier flowers, the fruit set satisfactorily. The dry weather prevailing during the ripening period favoured the crop, with the result that the harvest consisted of good large clean fruits which were firmer than usual, and consequently travelled better than this fruit normally does.

Where new plantations are being laid down, the variety chiefly selected is Lloyd George. A comparatively new Dublin variety, "Sharp's Discovery," promises well, and the fruit, being large and firm, travels well. In Dublin market the prices this year ranged from 7d. to 1s. 2d. per lb.; in County Cork, 1s.; in Offaly, 10d. to 1s., and in County Tipperary 8d. per lb.

Loganberries.—These plants are easy to grow, as they succeed in almost any soil and in virtually any situation, and they seldom fail to yield a profitable crop. Owing to the unusually long spell of dry weather during the period of growth, the fruit this year was smaller, but the crop was

heavy. Where the plants were exposed to high winds the tips of the shoots suffered considerably, and the early frosts also did some damage, but not to a serious extent. In Dublin this fruit sold at from 8d. to 1s. per lb.; in Offaly and Cork at 1s., and in Tipperary at 8d.

Red and White Currants.—These plants sustained a good deal of damage from the depredations of caterpillars of the Currant Sawfly. These insects stripped the foliage off a large number of bushes, and in consequence the fruit on those bushes was stunted and lacking in flavour. Nevertheless, the crop generally was very heavy and in most centres the supply exceeded the demand, with the result that prices were low, averaging 5d. to 6d. per lb. in Dublin; 6d. in Counties Cork and Kilkenny, 4d. in County Longford and 3d. to 6d. per lb. in County Meath. The varieties Raby Castle, Red Dutch and Laxton's Perfection bore heavy crops of large clean fruits.

Black Currants.—The yield of this fruit was reported generally to be the heaviest in recent years, especially in Counties Cork, Limerick, Longford, Tipperary, Wexford and Wicklow, and in the majority of cases the fruit was stated to be of very high quality. In the Dublin market early berries sold at from 10d. to 1s. per lb., but later the price dropped to 6d. per lb. In County Carlow this fruit made 6d. to 8d. per lb.; in County Cork 10d. to 1s ; in County Galway 6d.; in County Meath 8d. to 9d.; in County Monaghan 1s.; in County Tipperary 5d.; and in County Wexford 10d. per lb.

In Counties Waterford and Sligo growers were offered by jam manufacturers 34s. per cwt. carriage paid for black currants. The growers consider this to be an uneconomic price.

Apples.—This year the crop is variable. In some orchards and gardens both early and late varieties are bearing heavily; while in others early varieties are bearing heavily and late varieties lightly. In almost all cases where the trees are in sheltered positions they give promise of a good yield, a fact which demonstrates anew the importance of choosing suitably sheltered positions for apple trees if the best results are to be obtained. Trees in exposed positions suffered considerable damage from high winds, hail showers and frost during the flowering period. It is the general experience that trees which bore a heavy crop last year are bearing a light crop this year. This is most noticeable in the case of old trees in grass orchards, and more particularly in the varieties Allington Pippin and Newton Wonder.

The crop on the whole is expected to be slightly above the average, but owing to the long period of drought the present state of the trees would indicate that the fruits will be smaller, while on the other hand they will be more highly coloured and cleaner in appearance and generally in a better condition for marketing.

In County Carlow the crop looks as if it would be good, and this also applies to County Cavan, except in low-lying districts where the trees were affected by frost in late May and early June. The varieties doing best are Bramley's Seedling, Newton Wonder, Lord Derby, Early Victoria, Grenadier, Charles Ross, Beauty of Bath, Mr. Gladstone and Lane's Prince Albert. In County Cork, Bramley's Seedling, Newton Wonder and Lane's Prince Albert promise well, but Mr. Gladstone, Beauty of Bath and Early

Victoria are not doing so well as was anticipated. In County Kerry Bramley's Seedling is a light crop, whilst Early Victoria, Worcester, Pearmain, Beauty of Bath and The Queen are bearing well. In County Kilkenny, Bramley's Seedling is particularly promising, while Beauty of Bath, Worcester Pearmain, Lord Derby, Golden Spire and Charles Ross are good, but James Grieve and Lane's Prince Albert are much less promising. In Leix the early varieties, with the exception of Beauty of Bath, are poor, while the late varieties, more particularly Bramley's Seedling, are good. In Counties Longford, Wicklow and Sligo the early varieties are good, but the late varieties are not up to the normal in either numbers or size. In County Monaghan the trees made a good show of blossom, and the fruit set well, but owing to the prolonged dry weather many of the fruits dropped from the trees. In County Tipperary, which had a light crop last year, the trees are bearing well and the fruit is of good quality. In County Westmeath the prospect of a really good crop, especially among the early varieties, is exceedingly promising.

Pears.—Present indications point to a smaller than average crop this year. Generally speaking, while a few trees in the open are bearing well these are exceptional, and it is only on trees growing against walls in sheltered situations, where they have received adequate attention, that an average crop is being produced. The fruit is swelling normally and promises to be of very good quality. In the Northern and Midland counties the crop is poor owing to the prevailing low temperatures during the flowering period. This is the normal experience and is the chief reason why so few pears are grown in that area. In County Dublin the trees flowered well, but except in sheltered situations the fruits failed to set well. The best are Jargonelle, Pitmaston Duchess and Williams' Bon Chretien. In County Limerick the crop promises to be good on walls and fair in the open, especially in the case of Williams' Bon Chretien, Doyenne du Comice, Durondeau and Pitmaston Duchess. In County Waterford, where this fruit is usually successful, the crop is good on walls but poor in the open, Williams' Bon Chretien and Pitmaston Duchess doing best.

Plums are one of the most uncertain fruit crops in this country, owing to their susceptibility to bad weather conditions. They are amongst the earliest of the trees to flower, and are consequently exposed to risk at the period when the climate in this country is apt to be in its most rigorous mood. Reports generally indicate that the present is one of the worst years for plums for a considerable period. The fruit is not only poor in quality, but it is not swelling as rapidly as it should do, and it is anticipated that it will be small in size. In County Westmeath an average crop is anticipated. In County Dublin, Victoria and Kirks promise to yield a fair crop, but the other varieties flowered poorly and the fruits set badly. In County Limerick the crops are fair in the open and good on walls, especially the varieties Victoria, Magnum Bonum and Rivers Early.

Cherries were a good crop this year, especially in Counties Kildare, Dublin, Wicklow, Wexford and Waterford. Morellos on walls bore well, as is usually the case, and the sweet varieties, particularly May Duke and White Heart, were good. Prices ranged from 1/- to 8d. per lb.

Other Fruits.

This year was much more favourable than last for peaches and figs and the trees generally are bearing considerably more fruit, and the fruits are of larger size and better flavour. In Counties Cork, Dublin, Galway, Kilkenny, Limerick, Meath and Tipperary the crop is good. Few trees of these fruits are cultivated out-of-doors in the more northern counties of the Irish Free State.

Insect, Fungoid Pests, etc.

Aphis, or green fly, has proved the most troublesome of the insect pests this year, attacking both bush and tree fruits, especially apples, plums, gooseberries and black currants. Black Aphis did a good deal of damage to the tips of the shoots of cherry trees. In Counties Mayo, Offaly and Waterford, some damage was caused by Black Currant Mite. Gooseberry and Currant Sawfly did much damage in many cases where timely spraying had not been carried out. This insect does not attack the bushes until the fruit is formed, and growers as a rule do not then care to spray. Some damage was also caused by Apple Sucker, and Winter, Lackey, Ermine, and Tortrix Moth Caterpillars. Capsid bug appears to be still on the increase in County Sligo. American blight, or Woolly Aphis, was not so severe as in past seasons. On the whole the damage caused by insect pests was not as great as in previous years. Spraying with tar-oil and other insect-killing sprays is now generally practised by up-to-date fruit growers. Considerable damage was done to pears, plums, and gooseberries in Counties Clare, Cork, Longford, Leix, Sligo and Wexford by the attacks of bullfinches.

In the Western Counties, Coral Spot or Cluster Cup on gooseberries was one of the worst pests of the year, and caused much damage to both fruit and foliage, especially in orchards and gardens which had not received proper attention. Generally speaking, however, less damage than usual was occasioned by fungoid pests this year, partly because of the exceptionally dry season, and partly also because of the precautions adopted by the growers in spraying the trees. Apple and Pear Scab, which usually do much injury to the fruit, are not so much in evidence this year, and the fruit promises to be cleaner in appearance.

SUGAR BEET EXPERIMENTS, 1928.

PREVIOUS TRIALS.

Reports on the results of experiments on the cultivation of sugar beet which were conducted by the Department in each of the years 1925, 1926 and 1927 appeared in the following issues of the Department's Journal: Vol. XXVI., No. 1; Vol. XXVII., No. 1; and Vol. XXVIII., No. 1, and also in pamphlet form.

THE 1928 EXPERIMENTS.

In the 1928 season the Department again arranged for the conduct of experiments with sugar beet under the supervision of the Agricultural Instructors, also at the Albert Agricultural College (University College, Dublin) and at the Department's Farms at Athenry, Ballyhaise, Clonakilty and the Munster Institute. These experiments embraced trials with varieties, manures and sugar factory waste lime, and also tests in the cultivation, harvesting and storing of the crop and in the production of ensilage from beet tops.

I.—EXPERIMENTS CONDUCTED BY THE AGRICULTURAL INSTRUCTORS.

Variety Trials.

The variety and top-dressing trials conducted by the Agricultural Instructors in 1925, 1926 and 1927 had shown that the varieties Kuhn (P) and Klein-Wanzleben (Z) were definitely superior as regards both yield and sugar content to the other varieties tested, and these trials had also revealed the results to be expected from the application to the beet crop of a top-dressing of nitrate of soda at the rate of 1 cwt. per statute acre. Having regard to these results it was decided to discontinue the top-dressing trials with nitrate of soda and to test the relative merits of the varieties Kuhn (P) and Klein-Wanzleben (Z) by comparing each of them with a strain of the same variety, Kuhn (Pa) and Klein-Wanzleben (E) respectively, which it was anticipated would produce an appreciably heavier crop of roots containing a slightly lower percentage of sugar. Accordingly the experiments at each centre were confined to trials of these four varieties.

In all respects other than those mentioned above these variety trials were conducted by the Agricultural Instructors in 1928 on lines similar to those adopted in the case of the sugar beet trials carried out in the three preceding years, particulars of which were set out in the report for each year. The general conditions of the scheme of experiments were as follows :—

(1) That the area of the experimental plot at each centre should be one statute acre, except in the case of plots laid down in Counties Cavan,

Donegal, Galway, Leitrim, Longford, Mayo, Monaghan, Roscommon, Sligo, where the area of each plot should be one-quarter statute acre.

(2) That the experimental plot at each centre should be sub-divided into 4 equal parts and cropped with four varieties of sugar beet, namely,—Kuhn (P), Kuhn (Pa), Klein Wanzleben (Z) and Klein Wanzleben (E).

(3) That the sugar beet should be grown on land which in the previous season had been under tillage, preferably under corn, save that in districts where it is customary to grow roots after lea the beet might occupy the position usually taken by the root crop.

(4) That sugar beet grown on land which in the previous season had borne a corn crop should be manured with farmyard manure at the rate of about twelve tons per statute acre; and if considered necessary a similar dressing to be given in the case of plots laid down on "manured" land, *i.e.*, land under roots, potatoes or green crop in 1927.

(5) That the following dressing of artificial manures should be applied at the time of sowing the crop, irrespective of the previous crop or manuring—

4 cwt. Superphosphate (35%)	Per statute acre.
4 cwt. Kainit	
1 cwt. Sulphate of Ammonia	

(6) That the land on which the plots were to be laid down should be ploughed deeply, care being taken not to bring to the surface subsoil containing substances deleterious to plant growth.

(7) That the seed bed should be as finely prepared as is customary in the case of the turnip crop.

(8) That the width of the drills should not exceed 22 inches.

(9) That the seed should be sown at the rate of 18 lb. per statute acre, and not later in each district than is customary in the case of mangels, or as soon thereafter as a proper seed bed could be prepared.

(10) That the drills should be horse-hoed at least once within a month from the date of sowing the crop and that, if necessary, this operation should be repeated before the crop was singled.

(11) That the plants should be singled to nine inches apart as soon as they had developed four leaves, exclusive of the cotyledons or primary seed leaves.

(12) That subsequent to singling, and until the leaves had met across the drills, the crop should be hand-hoed and horse-hoed as often as might be necessary to check completely the growth of weeds, and to maintain the surface soil in a loose, friable condition.

(13) That the crop should be moulded up when the foliage of the plants had reached such a stage that further cultivation was no longer necessary or practicable.

(14) That the yield of the crop on the various sub-plots should be determined as soon as the crop had reached maturity.

(15) That representative samples drawn from the various sub-plots should be forwarded to the State Laboratory for analysis.

In accordance with this Scheme experiments were conducted at 142 centres throughout the Saorstát. The number of experimental centres in each county is shown in Table I.

TABLE I.

County.	Number of Centres.	
LEINSTER.		
Carlow	4	
Dublin	4	
Kildare	4	
Kilkenny	4	
Laoighis	4	
Longford	3	
Louth	4	
Meath	4	
Offaly	4	
Westmeath	3	
Wexford	4	
Wicklow	4	
		46
MUNSTER.		
Clare	6	
Cork	20	
Kerry	7	
Limerick	8	
Tipperary, N.	4	
,, S.	4	
Waterford	4	
		53
CONNAUGHT.		
Galway	8	
Leitrim	4	
Mayo	8	
Roscommon	8	
Sligo	3	
		31
ULSTER.		
Cavan	4	
Monaghan	4	
Donegal	4	
		12
TOTAL		142

Weather Conditions.

From November, 1927, to the middle of February, 1928, the rainfall was excessive. From 18th February to 10th March there was a period of dry weather, after which the weather again became wet and continued so until 11th April. The dry period which followed was broken by heavy rains during the 3rd week of April, after which the weather became unusually warm. May was, on the whole, a dry and fairly warm month, but the nights were cool and often frosty. Much-needed rain fell on the 17th, 26th and 27th days of this month. The weather during the four weeks following 10th June was almost continuously wet, cool and cloudy. The greater part of July was fine and fairly warm, but the weather in August was rather broken. During September and the first ten days of October the weather was generally quite good but from 15th October until the end of the year temperatures and rainfall were rather above normal.

Preparation of the Land for Seeding.

On account of the excessive rainfall during the period from November, 1927, to April, 1928, the ploughing and preparation of land for sugar beet was in a backward state when the weather became dry and settled after 11th April. The land then dried out very rapidly and heavy soils, in particular, were prepared with difficulty. At nearly 60 per cent. of the centres farmyard manure was put in the drills immediately before the seed was sown and at nearly half of the remaining centres the sugar beet crop was grown after a " manured " crop and artificial manures only were applied.

Seeding.

Up to the beginning of the present century the scientific breeding of sugar beet seed was directed primarily towards the production of the highest possible percentage of sugar in the beet. Within recent years, however, considerable attention has been devoted by seedsmen to the development of strains or types of sugar beet which produce a larger tonnage of roots per acre with only a slight decrease in the percentage of sugar and purity of juice as compared with their original types bred specially for a high sugar content.

Arrangements having been made to test the relative merits of the two above-mentioned types of seed, as produced by Messrs. Kuhn & Co., Naarden, Holland, and by Messrs. The Klein-Wanzleben Sugar Factory, Germany, supplies of seed of the four varieties at the rate of 18 lbs. per acre were supplied to the plotholders at all centres. Before the seed was despatched to the plotholders representative bulk samples of each of the

four varieties were drawn and tested for germination at the Department's Seed Testing Station with the following results:—

Variety.	*Germination per cent.*
Kuhn (P)	137
Kuhn (Pa)	140
Klein-Wanzleben (Z)	146
Klein-Wanzleben (E)	176

The weather during the last fortnight of April was quite favourable for the sowing of beet but only six per cent. of the plots were sown during that period, mainly on account of difficulty in preparing the land and the interference of other work which had been greatly delayed by wet weather. During the first ten days of May 47 per cent. of the plots was sown and during the second 10 days of the month a further 33 per cent. was sown. The remaining 14 per cent. of the plots was sown during the last eleven days of May, only one plot being sown in June. As a result of the dry conditions of weather and soil, which were general during the first half of May, germination of the seed was irregular at many centres. A regular stand of plants was, however, obtained at 85 per cent. of the total number of centres at which trials were conducted.

Singling and After Cultivation.

Singling of the crop at the majority of centres was carried out when the plants had developed four leaves exclusive of the two primary seed leaves. On the average, the plants reached this stage of growth within six or seven weeks after the date of sowing. Under favourable conditions of weather and soil the crop was ready for singling within about five weeks after sowing, but in many cases dry weather in May delayed germination of the seed and very cool, wet weather in June retarded growth of the braird. As a result the crop was not singled, in a number of cases, until eight weeks or more after it was sown. The wet weather in June rendered the control of weeds rather difficult, but only a few cases were reported where the crop received inadequate attention as regards after-cultivation and the moulding up of the drills before the leaves met across the furrows.

Harvesting.

In this country the maturity of sugar beet is not very clearly indicated, as in other countries, by the appearance of the crop, for in autumn and early winter there is little yellowing of the outer leaves, and growth does not cease. Typical samples of sugar beet have been carefully drawn at centres representative of the entire country from each season's crops, at fortnightly intervals from the end of August to the middle of the following February. These samples have served for the determination of the rate of

growth (weight of roots), the sugar content and purity of juice, throughout the autumn and winter. The data so obtained indicate that the optumum quantity of sugar is attained in November, and, accordingly, it was decided to complete, so far as possible in the month of November, the recording of the yield (tonnage) from the 1928 experimental plots and the sugar content of their produce.

The procedure adopted in ascertaining the yield of the crop on the various sub-plots was as follows:—An area of two statute perches representative of the general crop on each sub-plot was accurately measured off. The beets were lifted by hand, with the aid of a fork where necessary. Those which had bolted or were abnormally small were discarded. All loosely adhering soil was removed by scraping the roots with the back of the topping knife, after which the leaves and crown were cut off squarely at the point where the lowest leaf had originally appeared. When the roots from the measured area of two statute perches were scraped and topped, one quarter, by weight, of the roots was selected, having due regard to size and shape. From the roots, so selected, any branches or fangs, or portions thereof, of the thickness of an ordinary lead pencil were cut off, after which each root was thoroughly cleaned by washing and scrubbing. From the weight of such washed roots the "factory weight" for the produce of the whole sub-plot was then calculated.

After the roots had been weighed to ascertain the yield, a thoroughly representative sample consisting of not less than nine of the topped and washed roots from each sub-plot was despatched to the State Laboratory in Dublin, where, immediately after arrival, each sample was analysed for sugar content in accordance with the usual practice adopted by beet sugar factories.

Of the 142 centres where experiments were laid down, complete returns were obtained from 129 centres.

From 13 centres at which the experiments were conducted complete results were not obtained for the following reasons:—At one centre in each of the counties Donegal, Galway, Leitrim, and Longford, and at two centres in Cavan, the seed germinated poorly and the crop was patchy, chiefly on account of the unsuitability of the soil. At one centre in Kerry and at another in Roscommon the crop was affected in a similar manner by dry weather between the time of sowing and singling, and at one centre in Cork the crop was very patchy as a result of an attack of phoma or crown rot. In all of the foregoing cases no weighings or samples were taken. At two centres in Cork and one in Roscommon the experiments were not conducted in accordance with the scheme, and although returns were obtained from the two centres in Cork these returns are not included in the Tables. At one centre in Co. Kerry, where all the farm crops and stock were sold, it was impossible to obtain any returns from the sugar beet experiments.

Detailed particulars in respect of all centres from which complete returns were obtained are shown in Table II. and a summary of the results appearing in Table II. is shown in Table III. These tables will appear in

a Report which will be issued shortly as a separate publication, and of which copies may be obtained on application to the Department.

The results shown in the foregoing tables were obtained from 129 centres at which 516 sub-plots were laid down. The returns from these 516 sub-plots show that the average yield of beet was 10 tons 8 cwts. (factory weight) per statute acre and the average sugar content of the samples was 17·6 per cent. A comparison of the returns from the two standard varieties Kuhn (P) and Klein-Wanzleben (Z) shows that, on the average, the Kuhn (P) variety was slightly superior in yield to the Klein-Wanzleben (Z) variety and that there was no difference between these two varieties as regards sugar content. As previously explained, however, the main object of these variety trials was to compare the two standard varieties Kuhn (P) and Klein-Wanzleben (Z) with a type of each of these varieties which was expected to produce a considerably heavier crop of roots containing a slightly lower percentage of sugar. In these respects the Kuhn (Pa) type proved to be disappointing, as the average returns indicate that there is practically no difference in either the yield or sugar content of this variety as compared with its correlated type Kuhn (P). A similar comparison of the returns from the Klein-Wanzleben types (Z) and (E) reveals differences in yield and sugar content which are recognised as characteristic of the two types. The average yield of the Klein-Wanzleben (E) type was 15 cwt. per acre more but the sugar content was 0·5 per cent. less than in the case of the (Z) type. On the basis of these figures the yield of roots per acre from the (E) type was over 7 per cent. greater than from the (Z) type and allowing for the lower sugar content of the (E) type, the yield of sugar per acre therefrom was over 4 per cent. greater than from the (Z) type. Though it will be necessary to continue these trials over a period of years before a definite conclusion can be drawn as to the relative merits of these two types of sugar beet, it may be observed that an increase in the yield of sugar per acre resulting from a higher yield of roots containing a lower percentage of sugar is counterbalanced to some extent by higher expenses for transport.

Influence of place in rotation.

At the 129 centres from which complete returns were received the sugar beet was grown after a corn crop at 83 centres and after potatoes or a manured root crop at 46 centres. From the results of these experiments no definite conclusion can be formed as to the influence of the preceding crop on the yield or sugar content of the beet, but it is clearly shown that sugar beet can be grown successfully in a variety of positions in the rotation.

Soils.

At the majority of centres at which the experiments were conducted the soil was described as either medium or heavy loam.

At six centres the soil was said to be of a moory or peaty nature, and at twenty-four centres the soils were described as light or sandy loams.

Whilst the average returns, both as regards yield and sugar content, obtained from the different types of soil showed no marked difference, a slightly higher average yield was obtained from the beet grown on heavy and peaty soils and a slightly higher average sugar content was present in the beet grown on the lighter soils. In general, however, such differences would appear to be seasonal and may be attributed to the effects of the moisture content of the soil at critical periods during the growth of the crop.

Manuring.

At the centres where farmyard manure was applied directly to the sugar beet crop it was ploughed in during winter at 25 centres and it was applied in the drills immediately before the seed was sown at 79 centres. On the plots where the farmyard manure was applied in winter the beet was somewhat superior, both in yield and sugar content to the beet grown on the plots to which farmyard manure was applied in spring, but this, of course, may have been largely due to factors other than the time of application of the farmyard manure.

At twenty centres where the beet followed a root crop or potatoes and was grown on artificial manures only and at five centres where the beet was grown after a corn crop and was manured with artificials only, the average yield and sugar content of the beet was slightly above the general average.

Bolting and Forking.

Although bolting did not occur to any great extent in the 1928 crop, the returns afford further evidence that bolting is influenced by the date of sowing and by subsequent weather conditions. Bolting was most prevalent in the case of crops where growth was retarded in the very early stages as a result of dry weather in May followed by a prolonged period of wet weather and low night temperatures during June. Brairds which were well advanced in growth before the end of May produced fewer bolted plants than crops sown somewhat later. The Klein-Wanzleben (Z) type produced rather more bolted plants than the (E) type of this variety. The Kuhn (P) and (Pa) types, which were very similar as regards bolting, produced on the average less than a third of the number of bolted plants produced by the Klein-Wanzleben (Z) type. In fact, at the majority of centres bolting was practically absent in the Kuhn varieties.

In nearly all cases the shape of the roots was satisfactory, but at a number of centres a rather large proportion was forked. The experiments provide some evidence that forking may be associated with soils of the heavy, peaty and gravelly types. On the other hand, the results indicate that the application of 12 tons of well-rotted farmyard manure per acre in the drills immediately before sowing did not result in the production of an undue proportion of forked roots.

Pests and Diseases.

The crop at almost all centres was remarkably free from attack by insects and other pests. The yield was materially affected by mangel fly at only a few centres. A severe attack of black aphis was reported at two centres, but the yield of the crops appeared to be but slightly affected. The weather, particularly in September, was unfavourable to the development of fungoid diseases affecting the leaves of sugar beet and no damage of this nature was reported. Phoma, or crown rot, was reported as having caused damage at only four centres.

MANURIAL EXPERIMENTS.

In view of the general practice regarding the manuring of the sugar beet and mangel crops, it was decided, in the case of the sugar beet experiments conducted by the Department in 1925, that the manurial dressing per statute acre to be applied to all experimental plots should be as follows:—

12 tons farmyard manure.
4 cwt. superphosphate (35 per cent.).
4 ,, kainit.
1 ,, sulphate of ammonia.

The above mixture of artificial manures gave such satisfactory results when applied to the experimental plots in 1925 that it has been adopted as the standard manurial dressing for both experimental and commercial crops of sugar beet grown since that year. In order, however, to determine whether this standard dressing of artificial manures or some modification thereof was likely to give the most satisfactory results when applied to sugar beet, a series of manurial trials with various mixtures of artificial manures was conducted by the Department in 1926 and somewhat similar series of manurial trials were carried out in 1927 and 1928. The results of these manurial trials in 1926 and 1927 were included in the reports on the sugar beet experiments in 1926 and 1927 which were published in the Department's Journal, Vol. XXVII., No. 1,, Vol. XXVIII, No. 1., and also in pamphlet form.

In 1928, as in the previous years, these trials were confined to Counties Carlow, Kildare, Kilkenny, Laoighis, Offaly, Tipperary (N.R.), Waterford, Wexford and Wicklow, where the bulk of the supplies of sugar beet for the Carlow factory were grown. The experiments were conducted at four centres in each county, except County Wicklow, where the trials were carried out at only two centres. The plots were laid down at almost all centres on land which in the previous season had been cropped with lea oats. In all cases a dressing of farmyard manure was applied uniformly at the rate of 12 tons per statute acre, either during the winter before the land was ploughed or in the drills in the spring. At each centre five-eighths of a statute acre was divided into ten uniform plots, each com-

prising five drills. The following dressings of artificial manures were applied to the respective plots at each centre:—

PLOT.	MANURES.	
I.	3 cwt. superphosphate (35%) 4 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
II.	5 cwt. superphosphate (35%) 4 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
III.	4 cwt. superphosphate (35%) 3 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
IV.	4 cwt. superphosphate (35%) 5 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
V.	4 cwt. superphosphate (35%) 4 ,, kainit 1 ,, sulphate of ammonia	per statute acre.
VI.	5 cwt. superphosphate (35%) 5 ,, kainit 1¼ ,, sulphate of ammonia	per statute acre.
VII.	4 cwt. superphosphate (35%) 4 ,, kainit 2 ,, sulphate of ammonia	per statute acre.
VIII.	4 cwt. superphosphate (35%) 4 ,, kainit Nitro-chalk sufficient to supply the same quantity of nitrogen as is contained in one cwt. of sulphate of ammonia.	per statute acre.
XI.	4 cwt. superphosphate 35(%) 4 ,, kainit 1 ,, nitrate of soda	per statute acre.
X.	4 cwt. superphosphate (35%) 4 ,, kainit 2 ,, nitrate of soda	per statute acre.

The artificial manures were applied immediately before the seed was sown, except in the case of Plots IX. and X., to which the nitrate of soda was applied as a top-dressing. Plot IX. received a top-dressing at the rate of 1 cwt. per statute acre, immediately after the crop was singled, and Plot X. received a similar top-dressing at the same time. In addition, the latter plot received a second top-dressing at the same rate a week or two later.

The Kuhn (P) variety of seed was sown on all the plots at all centres.

The general cultivation of the crop on these plots was the same as in the case of the variety trials already referred to. Throughout the growing season very little difference was noted at most centres in the appearance of the crop on the various sub-plots except that in the case of Plot VII.,

which received the dressing of 2 cwt. of sulphate of ammonia, and Plot X., which received the dressing of 2 cwt. of nitrate of soda per statute acre, the growth of foliage was, as a rule, somewhat more vigorous throughout the growing season than in the case of the other plots. It was reported that at the time when weighings were taken for the determination of yield there was very little outward indication of ripeness of the crop on any of the plots, and at the majority of the centres this was particularly noticeable in the case of Plots VII. and X. which received the heavier dressings of nitrogenous manures.

The procedure adopted with regard to the weighing, sampling and analysis of the produce of these plots was the same as in the case of the variety trials conducted by the Agricultural Instructors, except that plants which had bolted were included in the quantities weighed for the determination of the yield.

Of the 34 centres at which experiments were laid down complete returns are available from 31 centres. Reliable returns could not we obtained from three centres where the crops were very patchy.

Detailed particulars in respect of the 31 centres from which complete returns were obtained are shown in Table IV. (facing page 114).

The average returns from the different plots at all centres are surprisingly uniform. The standard manurial dressing applied at the normal rate produced on the average a slightly higher yield than any of the other dressings excepting that containing two cwt. of sulphate of ammonia. The larger quantity of the standard mixture or dressing, *i.e.*, 11¼ cwts. (Plot VI.), as against 9 cwts. (Plot V.) per statute acre, produced a heavier crop of beet—an increase which more than sufficed to defray the cost of the additional manure. On the other hand the lighter dressings of superphosphate and kainit and the application of nitrogen in the form of a top-dressing of nitrate of soda at the rate of one cwt. per statute acre produced a lower yield than did the standard dressing. The average yield of the crops on the plots which received nitro-chalk was somewhat lower but the sugar content was slightly higher than in the case of the plots to which the standard dressing was applied, and the returns afford some evidence that nitro-chalk may prove to be a satisfactory source of nitrogen for sugar beet when grown on land which is deficient in lime. The heavier dressing of kainit, as well as the dressing which contained nitro-chalk, produced crops having an average sugar content slightly higher than that produced by the standard dressing, but the dressings containing extra superphosphate and extra nitrogen, in the form of either sulphate of ammonia or nitrate of soda, produced crops having an average sugar content slightly lower than that produced by the standard dressing.

Having regard to the results obtained from the plots to which the standard dressing of 4 cwt. superphosphate, 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre was applied, it is evident that this mixture can be relied upon to give satisfactory returns on most soils, and pending the results of further manurial trials, the Department recommend the use of this mixture, with a proviso that a top-dressing of nitrate of soda at the rate of about one cwt. per statute acre should be applied a few days after the crop is singled, or even before singling, where the crop is attacked

by insect pests or where growth has been seriously interfered with through adverse weather conditions or other causes.

Trials with Sugar Factory Waste Lime.

In the process of manufacturing beet sugar large quantities of burnt lime are used, and from this process there results a by-product commonly known as "waste lime." This by-product as it leaves the filter presses in the factory contains approximately 50 per cent. of water, 10 per cent. of lime in the form of calcium carbonate, and small quantities of nitrogen and phosphates.

Waste lime is usually available to beet growers, especially in the vicinity of the factory, at a very low price and is, therefore, used extensively in some countries chiefly as a cheap source of lime for agricultural purposes. It is rather difficult to handle when fresh, on account of its wet, sticky condition, but after exposure for some time to the air in dry weather, it can be spread on the land without very much difficulty.

In order to ascertain the effects on the sugar beet crop when waste lime from the Carlow factory was applied to the land, in the autumn or winter before the beet crop was grown, a series of trials was conducted by the Agricultural Instructors at thirteen centres in the counties from which the Carlow Sugar Factory draws its main supplies of beet. The procedure adopted in carrying out the experiments was as follows:—

In each field a representative plot of ground, either one acre or half acre in area, was measured off and was dressed, in the autumn or winter season, before the beet crop was sown, with sugar factory waste lime at the rate of, approximately, 4 tons per statute acre.

The measured area in each field, as well as a similar area alongside to which no lime was applied, was sown with sugar beet in 1928, and subsequently the two plots were treated in exactly the same manner. At two centres an additional plot adjoining the other two plots was dressed with burnt lime at the rate of 2 tons per statute acre.

The methods of after-cultivation, weighing and sampling of the crop on the different plots, were the same as in the case of the variety experiments conducted by the Agricultural Instructors.

At two centres the crop was reported as being somewhat patchy, and at one centre the crop was attacked by phoma. The effects of this disease were more severe on the plot which received waste lime than on the plot to which no lime was applied. At four centres it was observed that the foliage of the plants on the limed plot was more vigorous than that on the unlimed plot, but the reverse was the case at two other centres. At five centres the growers complained that the waste lime was difficult to handle and spread, but in other cases where it was stored under cover for some weeks prior to use, no great difficulty was experienced in distributing it uniformly over the plot.

The returns from the different centres are shown in Table V. facing page 115.

Although the average returns as regards yield and sugar content are slightly better from the waste lime plots than from the plots which received no lime, the differences in the returns are not significant.

Showing Results of Manurial Trials

No.	Name and Address of Plotholder.	Nature of Soil	Crop grown on land in 1927	Date of Sowing	Date of Singling	Date of Weighing Crop	Date of Analysis of Samples	Yield per Statute Acre: cwt. 3 Super. 4 Kainit 1 Sulph. Amm.	cwt. 5 Super. 4 Kainit 1 Sulph. Amm.	cwt. 4 Super. 3 Kainit 1 Sulph. Amm.	cwt. 4 Super. 5 Kainit 1 Sulph. Amm.	cwt. 4 Super. 4 Kainit 1 Sulph. Amm.
								T. C.	T. C.	T. C.	T. C.	T. C.
	Co. Carlow.											
150	Dowling, William, Ballyhacket, Tullow.	Strong Loam	Lea Oats	5 May	30 May	21 Nov.	3 Dec.	12 11	12 11	13 8	13 3	14 2
168	Griffin, P. J., Slanequarter, Tullow	Medium Loam	Wheat	3 May	4 June	6 Dec.	10 Dec.	13 2	13 7	14 5	14 4	14 11
72	Doyle, Edward, Craans, Tullow ...	Light Loam (Moory)	Lea Oats	4 May	22 May	8 Nov.	13 Nov.	11 5	11 5	11 0	11 0	11 7
101	Doyle, James, Ballinagrane, Borris	Medium Loam	Lea Oats	2 May	24 May	16 Nov.	20 Nov.	9 14	11 12	10 14	10 8	12 0
	Co. Kildare.											
142	Duffy, Patrick, Mountrice, Monasterevan.	Dark Loam	Lea Oats	18 May	12 July	27 Nov.	29 Nov.	10 0	10 18	10 5	10 15	10 14
81	McNally, Andrew, Grouse Lodge, Monasterevan.	Clay Loam	Lea Oats	15 May	2 July	13 Nov.	15 Nov.	8 7	8 16	8 14	9 7	9 4
61	Malone, Simon J., Clonmoyle ...	Clay Loam	Lea Oats	10 May	4 July	8 Nov.	12 Nov.	9 16	10 8	9 18	10 4	10 2
46	Cunningham, Michael, Round Tower House, Kildare.	Deep Loam	Lea Oats	23 May	2 July	7 Nov.	9 Nov.	10 13	11 0	10 13	11 5	10 16
	Co. Kilkenny.											
106	Comerford, Stephen, Loughinney, Woodsgift.	Medium Loam	Oats	21 May	3 July	16 Nov.	20 Nov.	8 2	8 12	7 10	8 12	8 2
56	Mathers, James, Rathcash, Clifden	Medium Loam	Wheat	4 May	14 June	8 Nov.	10 Nov.	10 6	11 3	10 6	9 15	10 3
35	Hughes, Nicholas, Balief, Woodsgift.	Medium Loam	Oats	7 May	19 June	6 Nov.	8 Nov.	10 12	10 12	9 0	11 9	10 12
	Laoighis.											
65	Costelloe, Michael, Upper Lea, Portarlington.	Heavy Loam	Barley	8 May	8 July	8 Nov.	12 Nov.	11 5	10 8	10 4	9 7	10 3
25	Shiel, Laurence, Cuffsborough, Ballacolla.	Light Loam	Oats	7 May	18 June	2 Nov.	7 Nov.	11 6	11 8	12 0	11 17	12 3
9	Carey, John, Tentoul, Ballacolla ...	Loam	Barley	7 May	15 June	30 Oct.	2 Nov.	9 7	9 15	10 6	8 18	10 5
10	Neary, Joseph, Cullohill, Rathdowney	Medium Loam	Oats	3 May	14 June	29 Oct.	2 Nov.	8 14	10 6	9 9	8 17	9 13
	Offaly.											
141	Mahon, John, Enehan, Portarlington	Heavy Moor	Lea Oats	18 May	28 June	28 Nov.	29 Nov.	11 2	11 12	11 3	12 15	12 10
73	Keegan, William, Sragh, Tullamore	Deep Loam	Lea Oats	10 May	19 July	10 Nov.	13 Nov.	11 10	11 12	10 12	10 8	10 12
98	Carroll, Lawrence, Clonad, Killeigh, Tullamore.	Stiff Alluvial Soil	Lea Oats	16 May	12 July	15 Nov.	19 Nov.	11 18	12 13	11 8	10 6	10 15
	Co. Tipperary, N.R.											
182	Donohoe, John, Bushey Park, Borrisokane.	Clay Loam	Oats	16 May	9 July	11 Jan.	15 Jan.	10 0	10 7	10 9	10 10	12 3
180	Horan, Hugh, Knockshegowna, Shinrone, Roscrea.	Strong Clay	Lea Oats	8 May	26 June	19 Dec.	21 Dec.	6 11	6 17	7 3	7 13	7 4
169	Tooher, P., Curraduff, Birr ...	Strong Clay Loam	Oats	18 May	3 July	7 Dec.	10 Dec.	10 0	10 8	9 10	10 2	9 16
	Co. Waterford.											
166	Power, Mrs. Mary, Ballyknock, Dungarvan.	Shingly Loam	Lea Oats	7 May	16 June	5 Dec.	7 Dec.	13 9	14 3	13 6	14 7	13 4
122	Higgins, John, Kilgnovan, Dungarvan	Deep Sandy Loam	Oats	25 April	5 June	20 Nov.	26 Nov.	15 9	16 18	17 9	15 14	16 18
109	Butler, John, Liccaun, Dunmore East	Medium, Red Sandstone Loam	Lea Oats	14 May	3 July	17 Nov.	22 Nov.	10 15	12 2	11 12	11 14	10 19
64	O'Donovan, Michael, Gurrane, Modeley's, Cappoquin.	Shingly Red Sandstone Loam	Lea Oats	5 May	26 June	8 Nov.	12 Nov.	9 6	10 6	10 6	11 0	11 9
	Co. Wexford.											
103	O'Neill, Mrs. M., Shanoo, Bridgetown	Clay Loam	Lea Oats	12 May	23 June	14 Nov.	20 Nov.	13 10	15 0	14 5	14 12	14 0
92	Scallan, Peter, Clonroche ...	Shingly Loam	Lea Oats	19 May	1 July	15 Nov.	19 Nov.	12 10	14 5	14 0	14 0	13 15
80	Furlong, Thomas, Knockreigh, Adamstown.	Shingly Loam	Lea Oats	18 May	9 July	13 Nov.	15 Nov.	7 0	7 5	7 18	8 5	8 15
21	Fortune, Richard, Doononey, Adamstown.	Sandy Loam	Lea Oats	14 May	6 July	5 Nov.	6 Nov.	9 10	10 5	10 0	9 5	10 15
	Co. Wicklow.											
158	Burke, Patrick, Lackeragh, Baltinglass	Deep Clay Loam	Oats	14 May	5 July	30 Nov.	4 Dec.	11 5	12 0	11 15	11 17	12 7
49	Owens, Patrick, Tinorin, Baltinglass	Medium Loam	Oats	7 May	27 June	7 Nov.	9 Nov.	11 5	11 11	11 3	11 2	11 8
	Averages for 31 Plots ...	—	—	—	—	—	—	10 13	11 5	10 19	11 1	11 6

PLAN OF EXPERIMENTS

at the Department's Farms at Athenry, Ballyhaise and Clonakilty and at the Albert Agricultural College, Glasnevin (University College, Dublin).

		Farmyard Manure Applied in Spring.	Farmyard Manure Applied in Winter.	
Varieties	12 Drills ...	... Kuhn (P)	Variety	Variety Experiments.
	12 ,, ...	... Kuhn (Pa)	,,	
	12 ,, ...	... Klein-Wanzleben (Z)	,,	
	12 ,, ...	... Klein-Wanzleben (E)	,,	
	12 ,, ...	... Schreiber	,,	
	12 ,, ...	... Dippe	,,	
	12 ,, ...	... Gartons	,,	
	12 ,, ...	... Marsters	,,	

Manurial and Cultivation Experiments.

Artificial Manures Applied at Different Seasons.	5 ,, ...	... Equivalent of 4 cwt. 35% Super., in form of Basic Slag, applied in Winter 4 cwt. Kainit, applied in Spring. 1 cwt. Sulphate of Ammonia, applied in Spring.	
	5 ,, ...	... 4 cwt. Super. 35%, applied at time of Sowing. 4 cwt. Kainit, applied in Winter. 1 cwt. Sulphate of Ammonia, applied at time of sowing.	
	5 ,, ...	... Equivalent of 4 cwt. 35% Super., in the form of Basic Slag, applied at time of sowing. 4 cwt. Kainit, applied at time of sowing. 1 cwt. Sulphate Ammonia, applied at time of sowing.	
	5 ,, ...	... 4 cwt. Super. 35%, applied at time of sowing 4 cwt. Kainit, applied at time of sowing. 1 cwt. Sulphate Ammonia, applied at time of sowing.	
	5 ,, ...	... 4 cwt. Super 35%, applied at time of sowing. 4 cwt. Kainit, applied at time of sowing. 2 cwt. Sulphate Ammonia, applied at time of sowing.	
Width of Drills.	6 ,, ...	... 21" Drills. Singled, 9" apart.	
	6 ,, ...	... 24" .. .. 9" ..	
	6 ,, ...	... 18" .. .. 9" ..	
Singling at Different Distances Apart.	3 ,, ...	... 18" Drills Singled, 8" apart.	
	3 ,, ...	... 18" .. .. 12" ..	
	3 ,, ...	... 24" .. .. 8" ..	
	3 ,, ...	... 24" .. .. 12" ..	
	3 ,, ...	... 21" .. .. 8" ..	
	3 ,, ...	... 21" .. .. 12" ..	
Singling at Different Stages of Growth.	5 ,, ...	... 21" .. Singled at the "two-leaf" stage of growth.	
	5 ,, ...	... 21" .. .. ,, "four-leaf" stage of growth.	
Methods of Applying Nitrate of Soda.	5 ,, ...	... 4 cwt. Super. 35%, applied in drills at time of sowing 4 cwt. Kainit, ,, ,, 1 cwt. Sulphate of Ammonia ,, ,, 1 cwt. Nitrate of Soda ,, ,,	per statute acre.
	5 ,, ...	... 4 cwt. Super. 35%, applied in drills at time of sowing 4 cwt. Kainit. ,, ,, ,, 1 cwt. Sulphate of Ammonia ,, ,, 1 cwt. Nitrate of Soda applied as a top-dressing after singling.	,,
	5 ,, ...	... 4 cwt. Super, 35%, applied in drills at time of sowing. 4 cwt. Kainit, ,, ,, ,, 1 cwt. Sulphate of Ammonia, ,, ,,	,,
	5 ,, ...	... 4 cwt. Super. 35%, applied in drills, at time of sowing. 4 cwt. Kainit, ,, ,, ,, 149 lb. Nitrate of Soda ,, ,,	,,
	5 ,, ...	... 4 cwt. Super. 35%, applied in drills at time of sowing 4 cwt. Kainit, ,, ,, ,, 149 lb. Nitrate of Soda ,, ,, 1 cwt. Nitrate of Soda, applied as a top-dressing after singling.	,,

...nure of the same quality, it was arranged at each centre that,
...sorted out on to the sub-plot which was being

TABLE V.

Showing Results of Trials with Sugar Factory Waste Lime.

Name and Address of Plotholder.	Nature of Soil	Quantity of Waste Lime applied per statute acre.	Manuring per Statute Acre.				Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
			Farm Yard Manure	Super-phos-phate 35%	Kainit	Sul-phate of Am-monia	No Lime	Sugar Factory Waste Lime	Burnt Lime*	No Lime	Sugar Factory Waste Lime	Burnt Lime*
		T. C.	Tons.	Cwt.	Cwt.	Cwt.	T. C.	T. C.	T. C.	%	%	%
County Carlow.												
Doyle, Ed., Craans, Tullow ...	Light moory loam.	4 0	12	4	4	1	9 8	10 12	—	19·1	18·8	—
County Kilkenny.												
Mathers, Jas., Rathcash, Clifden	Medium loam.	4 0	12	4	4	1	10 0	9 15	—	18·6	18·1	—
Laoighis.												
Kenna, John, Pallas, Port-laoighise.	Heavy loam	4 10	15	4	4	1	9 4	10 3	—	17·0	17·9	—
Dowling, John, Derrydavey, Mountmellick.	Light Peaty loam.	4 14	12	4	4	1	10 11	10 5	—	18·8	18·7	—
Offaly.												
Burke, Patrick, Ballykilmurry, Tullamore.	Heavy clay loam.	4 0	12	4	4	1	8 4	8 5	—	15·3	16·3	—
Healion, Jas., Sragh, Tullamore	Medium loam.	4 0	12	4	4	1	8 7	8 5	—	17·2	17·5	—
County Tipperary, N.R.												
Gleeson, Tim, Moanahincha, Roscrea.	Black loam	4 0	—	4	4	1	6 7	5 8	7 13	17·5	17·0	17·4
Tooher, Patk., Curraduff, Birr ...	Black loam	4 0	—	4	4	1	7 17	6 11	—	17·5	17·6	—
County Waterford.												
Flynn, Thomas, Coolnagower, Dungarvan.	Deep Drift loam.	4 0	14	4	4	1	10 3	10 12	—	17·3	18·3	—
County Wexford.												
Pettit, Thomas, Ballyduskar, Killinick.	Sandy loam.	6 0	12	4	4	1	13 6	15 0	—	18·1	17·6	—
Scallan, P. Clonroche ...	Shingly loam.	4 0	15	4	4	1	11 18	12 5	12 10	17·4	17·8	17·7
County Wicklow.												
Breen, Peter, Croneyhorn, Shillelagh.	Clay loam	4 0	12	4	4	1	9 8	9 18	—	18·2	18·5	—
Burke, Patrick, Lackeragh, Baltinglass	Clay loam	4 0	12	4	4	1	10 6	10 17	—	17·1	17·1	—
Average (13 centres) ...		—	—	—	—	—	9 12	9 17	—	17·6	17·8	—

* Burnt lime was applied at two centres at the rate of two tons per statute acre.

CONDUCTED BY THE AGRICULTURAL INSTRUCTORS.

(FACTORY WEIGHT).					SUGAR CONTENT OF ROOTS.									
cwt. 5 Super. 5 Kainit 1¼ Sulph. Amm.	cwt. 4 Super. 4 Kainit 2 Sulph. Amm.	cwt. 4 Super. 4 Kainit Nitro-chalk.	cwt. 4 Super. 4 Kainit 1 Nitrate of Soda	cwt. 4 Super. 4 Kainit 2 Nitrate of Soda	cwt. 3 Super. 4 Kainit 1 Sulph. Amm.	cwt. 5 Super. 4 Kainit 1 Sulph. Amm.	cwt. 4 Super. 3 Kainit 1 Sulph. Amm.	cwt. 4 Super. 5 Kainit 1 Sulph. Amm.	cwt. 4 Super. 4 Kainit 1 Sulph. Amm.	cwt. 5 Super. 5 Kainit 1¼ Sulph. Amm.	cwt. 4 Super. 4 Kainit 2 Sulph. Amm.	cwt. 4 Super 4 Kainit Nitro-Chalk	cwt. 4 Super. 4 Kainit 1 Nitrate of Soda	cwt. 4 Super. 4 Kainit 2 Nitrate of Soda
T. C.	T. C.	T. C.	T. C.	T. C.	%	%	%	%	%	%	%	%	%	%
16 0	15 8	14 17	15 8	16 0	18·3	18·5	18·4	18·2	17·5	17·9	17·5	17·8	17·6	17·6
15 11	14 6	14 16	15 8	15 14	18·6	18·5	18·1	18·8	18·2	19 0	18·7	18·6	18·4	18·6
12 2	11 16	12 12	11 2	11 16	19·0	18·6	18·1	18·7	18·7	18·1	18·1	18·2	18·3	18·1
13 16	13 2	12 8	12 3	12 16	17·9	18·7	18·3	18·4	18·4	18·7	18·0	18·5	18·3	18·3
11 1	11 0	10 12	9 18	10 15	16·8	16·6	17·1	18·8	17·6	17·5	18·1	17·9	18·4	18·0
9 12	9 15	9 0	9 3	9 9	18·3	17·7	18·3	18·5	18·3	18·5	18·2	18·3	17·8	17·3
11 1	10 16	10 3	9 17	10 4	18·0	16·8	17·7	17·8	17·9	17·6	17·5	18·3	18·6	17·4
11 13	11 0	10 8	9 13	9 19	17·2	17·4	17·8	17·8	17·1	17·0	17·1	17·5	17·5	17·6
8 8	7 18	7 14	7 15	8 0	18·0	19·0	18·7	18·6	18·9	18·3	18·4	19·1	18·9	19·1
10 9	11 0	10 3	9 18	11 6	19·6	19·4	18·9	19·5	19·0	18·6	18·9	19·2	19·1	18·6
11 12	10 18	10 3	11 6	11 12	18·7	18·6	18·4	18·6	18·5	18·5	18·1	18·8	18·4	18·1
10 5	12 4	11 18	9 17	10 0	18·7	18·7	19·1	18·0	18·4	18·7	18·6	19·3	19·0	18·5
12 17	11 3	10 17	11 14	12 3	18·3	18·6	18·9	18·3	18·4	18·5	18·7	18·2	18·7	19·0
10 11	10 11	10 17	10 16	9 15	19·0	19·1	18·7	18·8	18·7	18·5	18·9	19·2	18·6	18·9
9 10	9 14	9 6	8 15	10 3	18·7	18·4	18·9	19·0	18·9	18·8	19·0	19·0	19·1	18·1
12 17	12 0	11 0	11 7	11 4	18·2	17·7	17·4	17·7	17·6	17·7	17·9	17·6	17·7	17·7
9 16	10 14	10 13	9 15	9 10	17·7	17·3	17·4	17·8	17·7	17·8	17·8	17·7	16·8	17·4
9 18	10 12	9 17	10 2	10 0	17·8	17·8	18·7	18·1	18·1	18·1	17·7	17·9	17·9	16·8
10 0	10 6	11 4	10 17	10 6	19·0	17·7	18·5	18·8	19·0	18·9	18·0	18·0	18·5	18·1
7 17	7 14	6 16	6 13	8 6	18·0	18·0	17·2	17·6	17·0	17·8	17·1	17·3	17·2	17·6
9 18	9 11	8 12	7 14	9 4	17·8	18·1	18·0	18·4	18·3	18·5	17·8	18·3	17·7	18·0
13 6	12 18	12 0	13 0	13 6	18·8	18·3	18·0	18·3	18·5	18·9	18·5	18·4	18·4	18·8
18 6	18 6	16 12	17 9	16 6	16·9	17·3	17·0	17·0	17·3	17·3	17·6	17·2	17·0	16·2
12 3	12 9	11 3	11 19	10 15	16·8	16·7	16·2	16·8	17·1	17·1	16·9	18·0	17·5	17·3
10 1	*9 14*	*9 15*	*10 0*	*9 10*	*19·2*	*19·4*	*18·7*	*18·3*	*18·9*	*18·8*	*18·4*	*19·0*	*18·6*	*18·7*
15 2	14 12	14 12	13 15	13 10	17·8	18·0	17·9	18·0	17·2	17·4	16·9	17·0	16·9	17·0
14 5	13 0	14 5	12 5	12 18	17·5	17·6	18·1	18·4	18·1	17·5	17·4	17·7	18·2	17·7
7 15	7 15	10 10	9 10	10 12	17·7	17·0	17·8	17·7	17·0	16·7	17·2	17·2	17·1	16·6
10 12	11 15	10 15	10 5	10 5	16·5	16·6	17·9	18·2	18·1	18·0	18·1	18 3	18·5	18·0
12 10	12 4	11 17	12 1	12 5	16·6	17·5	17·2	17·6	17·1	17·9	17·2	18·1	17·6	16·6
11 18	11 10	10 12	10 16	11 9	18·3	17·2	17·6	17·8	18·1	18·0	17 5	18·4	18·4	18·1
11 13	11 9	11 3	10 19	11 5	18·1	17·9	18·0	18·2	18·1	18·1	17·9	18·2	18·1	17·9

The returns from individual centres show marked variations which may, possibly, indicate corresponding variations in the lime requirements of these soils for the growing of sugar beet.

It would appear that the question of using waste lime for the sugar beet crop depends, in the first instance, on whether the particular soil is in need of lime and, secondly, whether waste lime will provide as economical a source of supply as burnt lime having regard to the much more concentrated and active nature of the latter and the ease with which it can be handled and distributed as compared with sugar factory waste lime.

II.—EXPERIMENTS AT THE DEPARTMENT'S FARMS AND AT THE ALBERT AGRICULTURAL COLLEGE (UNIVERSITY COLLEGE, DUBLIN).

During the season of 1927 experiments with sugar beet were conducted at the Department's farms at Athenry, Ballyhaise, and Clonakilty and also at the Albert Agricultural College, Glasnevin. These experiments comprised variety tests and, in addition, a series of trials arranged to determine the effects of:—

(1) The application of farmyard manure in winter and in spring.

(2) The application of nitrate of soda in drills at time of sowing and as a top-dressing after singling.

(3) The application of artificial manures at different seasons.

(4) Sowing the crops in rows or drills of different widths.

(5) Singling the plants to different distances apart.

(6) Singling the crops at different stages of growth.

Experiments were also conducted on the farm at the Munster Institute, Cork, with the object of determining the effects of varying quantities of phosphates on the yield and sugar content of the crop.

Experiments at Athenry, Ballyhaise, Clonakilty and Glasnevin Farms.

The experiments conducted at the above-mentioned centres in 1928 were arranged as shown on the plan facing page 115 and the procedure adopted in laying down the experiments at each centre was as follows:—

Two plots of one statute acre each were marked off at each centre. One plot was set aside for cultivation tests and trials with artificial manures while the second plot was reserved for variety trials and a comparative test of the effects of farmyard manure when applied to the land in winter and in spring.

The first plot was dressed uniformly with well rotted farmyard manure applied in the drill at the rate of 15 tons per statute acre. The plot intended for variety trials was divided into two equal portions by a line parallel to the longer dimension, and one half was dressed with farmyard manure at the rate of 15 tons per statute acre before the land was ploughed in winter. A similar quantity of farmyard manure was stored over winter in a heap in the open, and was applied to the other half of the plot in the drills before sowing. In order to ensure that both sub-plots would receive

farmyard manure of the same quality, it was arranged at each centre that, as the manure was being carted out on to the sub-plot which was being manured in winter, every alternate load should be placed in a heap adjacent to the corresponding sub-plot to be dressed with farmyard manure in spring. The heap when completed was compactly built so as to prevent undue losses through exposure to the weather and, before the manure was applied in spring, it was re-weighed in order to determine the loss in weight during storage. The shrinkage in weight at each centre was found to be as follows:—

Athenry	...	11 per cent.
Ballyhaise	...	22 per cent.
Clonakilty	...	16 per cent.
Glasnevin	...	7 per cent.

In preparing the land for the sowing of the seed in the variety trials, the drills were made across both sub-divisions of this one-acre plot, and the farmyard manure stored over winter was applied to the portion of this plot which had been reserved for that purpose. On the adjoining acre plot to which farmyard manure was applied in spring, the other tests, as previously described and as shown in the plan facing page 115 were carried out with seed of the Kuhn (P) variety.

Trials with Varieties and with Farmyard Manure applied in Winter and in Spring.

The one-acre plot at each centre reserved for variety trials, half of which had received a dressing of farmyard manure in winter, and the other half in spring, was set aside for trials with eight varieties, viz.:—Kuhn (P), Kuhn (Pa), Klein-Wanzleben (Z), Klein-Wanzleben (E), Schreiber, Dippe, Garton and Marsters. A dressing of 4 cwt. superphosphate (35 per cent.), 4 cwt. kainit and 1 cwt. sulphate of ammonia per statute acre was applied at each centre to the entire plot at the time of sowing. At all centres the drills were 21 inches in width, and the seed was dibbled in by hand to allow exactly 9 inches beween the plants when singled. At each centre 12 drills were sown with each of the eight varieties of seed.

The general cultivation, weighing, sampling and analysis of the crop on these plots were the same as in the case of the variety trials carried out by the Agricultural Instructors already described in this report. At the Ballyhaise centre, where the soil is very stiff and heavy, the crop was somewhat retarded by wet weather in June, but later in the season the crop made good progress. At the other three centres the crops on all the plots developed normally, and at no centre were the plants injured to any serious extent by pests or diseases. At none of the centres was there any apparent difference during the growing season in the crops to which farmyard manure was applied in winter and in spring; the crops grew and ripened uniformly and the number of bolted plants was almost negligible.

Particulars as to the yield and sugar content of the beet on the various sub-plots at each centre which received farmyard manure in winter, and on the corresponding sub-plots to which farmyard manure was applied in spring, are shown in Tables VI. and VII. respectively.

TABLE VI.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN WINTER.

VARIETY.	Yield per Statute Acre.				Sugar Content of Roots.				Average yield.	Average Sugar Content.
	Athenry.	Bally-haise.	Clona-kilty.	Glas-nevin.	Athenry.	Bally-haise.	Clona-kilty.	Glas-nevin.		
	T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
Kuhn (P.)	12 4	10 14	10 15	10 18	17·2	17·0	17·1	17·9	11 3	17·3
Kuhn (A.)	11 17	10 8	10 12	12 7	17·0	17·5	17·1	17·7	11 6	17·3
K.W.O. (Z.)	12 0	11 8	10 2	9 6	16·8	17·5	16·7	17·5	10 14	17·1
K.W.O. (E.)	12 0	10 7	11 18	10 5	16·4	16·9	16·9	16·9	11 3	16·8
Schreiber ...	12 11	9 2	9 14	9 15	16·6	17·9	17·0	18·1	10 5	17·4
Dippe ...	12 10	9 0	10 13	9 14	17·1	18·0	17·8	17·5	10 9	17·6
Marsters ...	13 14	10 8	11 6	10 17	16·9	16·5	17·6	18·4	11 11	17·4
Gartons ...	12 4	9 1	11 1	9 1	17·0	16·0	17·9	18·0	10 7	17·2

TABLE VII.

RETURNS FROM PLOTS TO WHICH FARMYARD MANURE WAS APPLIED IN SPRING.

VARIETY.	Yield per Statute Acre. (Factory Weight).				Sugar Content of Roots.				Average yield.	Average Sugar Content.
	Athenry	Bally-haise.	Clona-kilty.	Glas-nevin.	Athenry	Bally-haise.	Clona-kilty.	Glas-nevin.		
	T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
Kuhn (P.)	14 10	11 8	9 18	12 5	17·4	17·2	17·5	18·4	12 0	17·6
Kuhn (A.)	12 14	9 8	9 16	11 12	17·3	17·0	17·8	18·3	10 18	17·6
K.W.O. (Z.)	12 7	10 12	9 4	10 6	17·4	17·7	18·4	18·1	10 12	17·9
K.W.O. (E.)	13 3	10 13	11 2	12 0	17·0	17·3	16·8	17·1	11 15	17·1
Schreiber ...	13 0	10 8	11 0	10 5	16·7	17·6	17·5	18·0	11 3	17·5
Dippe ...	12 10	9 4	11 6	9 12	17·1	17·1	18·0	17·4	10 8	17·4
Marsters ...	15 0	9 1	11 10	8 14	17·2	16·8	17·8	18·1	11 1	17·5
Garton ...	14 10	9 0	10 7	8 5	16·1	16·5	18·2	19·0	10 11	17·4

The average yields produced by the varieties Klein-Wanzleben (Z), Schreiber, Dippe and Garton are appreciably lower than those produced by the other four varieties. Although the average yield of the Klein-Wanzleben (E) variety was slightly superior to that of any other variety, excepting Kuhn (P), it was inferior as regards average sugar content to any of the other varieties included in the trials at these centres.

On the average, slightly better yields were obtained from the plots to which farmyard manure was applied in spring than from the corresponding plots to which farmyard manure was applied in winter. This result was very marked at the Athenry centre. The average sugar content of the beet on the plots to which farmyard manure was applied in spring was also slightly higher than that of the beet on the plots to which farmyard manure was applied in winter.

Nitrate of Soda Applied in Drills at Time of Sowing and as a Top-dressing.

With the object of comparing the effects of nitrate of soda, when applied in the drill at the time the sugar beet seed is sown and when applied as a top-dressing immediately after the crop is singled, a series of plots was laid down at each centre as shown on the plan facing page —. This series of plots was also designed to afford a comparison of the values of sulphate of ammonia and nitrate of soda when used for sugar beet along with superphosphate and kainit. As regards cultivation all plots were, of course, treated in identical manner.

During the growing season no difference was observed in the general appearance of the plants on the different plots except at one centre where the crop on the plot to which nitrate of soda was applied as a top-dressing produced a heavier growth of leaves than was produced on the other plots. The returns from the different plots at each centre are shown in Table VIII.

TABLE VIII.

	Artificial Manures applied per Statute Acre.	Yield per Statute Acre (Factory Weight).				Sugar Content of Roots.				Average.	
		Athenry	Ballyhaise	Clonakilty	Glasnevin	Athenry	Ballyhaise	Clonakilty	Glasnevin	Yield (Factory Weight)	Sugar Content
		T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
1.	4 cwt. Superphospate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied in the drills at time of sowing.	11 0	9 2	11 1	10 10	16·6	17·7	17·7	16·9	10 8	17·2
2.	4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied as a top-dressing after singling.	12 0	8 11	10 8	11 5	16·4	17·3	17·6	17·9	10 11	17·3
3.	4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing.	12 2	8 13	10 11	10 8	16·4	17·4	17·1	17·5	10 8	17·1
4.	4 cwt. Superphosphate 35% applied in the drills at time of sowing 4 cwt. Kainit applied in the drills at time of sowing. 149 lb. Nitrate of Soda applied in the drills at time of sowing.	12 0	9 9	10 18	16 8	9·9	17·9	17·3	17·4	10 9	17·4
5.	4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 149 lb. Nitrate of Soda applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied as a top-dressing after singling.	12 1	10 0	9 16	10 10	15·9	17·2	17·3	17·0	10 12	17·0

It will be seen that the returns from the comparable plots were not very uniform at the five centres and that, on the average, there was little difference in the results obtained from the standard dressing of artificial manures and from the various manurial dressings containing nitrate of soda, irrespective of whether this latter ingredient of the mixture was applied before the seed was sown or as a top-dressing.

Winter and Spring Applications of Artificial Manures.

With the object of comparing the effects of dressings of basic slag and kainit applied in winter and in spring immediately before sowing with the standard dressing of artificial manures and a dressing consisting of 4 cwt. superphosphate, 4 cwt. kainit and 2 cwt. sulphate of ammonia per statute acre applied at the usual time, *i.e.*, in the drills at the time of sowing, a series of plots was laid down at each centre on the same lines as in the past two seasons, and as shown on plan facing page 115. The crops on all the plots were otherwise treated in exactly the same manner as the sub-plots in the variety trials, conducted at the same centres, which received an application of farmyard manure in the drills at the time of sowing.

During the growing season, no outstanding difference was noticeable in the general appearance of the plants on the different plots at any of the centres.

Particulars as to yield and sugar content of the beet on the various plots at each centre are shown in Table IX.

TABLE IX.

	Artificial Manures applied per Station Acre.	Yield per Statute Acre. (Factory Weight).				Sugar Content of Roots.				Average	
		Athenry	Ballyhaise	Clonakilty	Glasnevin	Athenry	Ballyhaise	Clonakilty	Glasnevin	Yield (Factory Weight).	Sugar Content
		T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
1.	The equivalent of 4 cwt. 35% Superphosphate in the form of High Grade Basic Slag applied in Winter. 4 cwt. Kainit, applied at time of sowing. 1 cwt. Sulphate of Ammonia, applied at time of sowing.	12 0	10 8	12 3	8 14	17·1	16·7	17·0	17·3	10 16	17·0
2.	4 cwt. 35% Superphosphate applied at time of sowing. 4 cwt. Kainit applied in Winter 1 cwt. Sulphate of Ammonia Applied at time of sowing.	11 3	11 8	11 15	10 7	17·1	16·6	16·9	16·9	11 3	16·9
3.	The equivalent of 4 cwt. 35% Superphosphate in the form of High Grade Basic Slag as in Plot (1), but applied at time of sowing. 4 cwt. Kainit applied at time of sowing. 1 cwt. Sulphate of Ammonia applied at time of sowing.	11 10	10 15	10 19	9 12	16·7	16·9	16·9	17·7	10 14	17·1
4.	4 cwt. Superphosphate 35% applied at time of sowing. 4 cwt. Kainit applied at time of sowing. 1 cwt. Sulphate of Ammonia applied at time of sowing.	13·4	9 12	10 15	9 15	16·9	17·5	18·0	17·3	10 16	17·4
5.	4 cwt. Superphosphate 35%, applied at time of sowing. 4 cwt. Kainit, applied at time of sowing. 2 cwt. Sulphate of Ammonia applied at time of sowing.	12 17	10 0	11 11	10 4	16·7	16·4	17·7	17·1	11 3	17·0

As there is little difference in the average returns from the various sub-plots, it may be inferred that good results may, in general, be expected where the standard dressing consisting of 4 cwt. superphosphate, 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre is applied, and that no appreciable advantage is to be gained by applying portion of this dressing in winter, or by substituting basic slag for superphosphate in the mixture.

Width of Drills.

As in the three previous seasons, a series of plots in which the drills were of varying width, was laid down at each centre. The general arrangement of the plots was as shown on the plan facing page 115. In all respects, except in the width of the drills, the crop on the plots was treated in exactly the same manner as that on the sub-plots in the variety trials, conducted at the same centres, which received an application of farmyard manure in the drills at the time of sowing. From one centre it was reported that some difficulty was experienced in avoiding injury to the plants when cultivating, with the ordinary implements, between the drills which were 18 inches apart. In the case of the drills 21 inches in width no such difficulty arose at any centre, and at two centres it was considered that 24-inch drills were wasteful, and encouraged the growth of weeds. The results of these trials are shown in Table X.

TABLE X.

Centre.	Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.
	T. C.	T. C.	T. C.	%	%	%
Athenry ...	10 8	12 8	12 0	17·5	17·5	17·1
Ballyhaise ...	9 2	9 12	10 8	17·3	17·7	17·6
Clonakilty ...	11 7	9 5	9 16	18·4	17·6	17·7
Glasnevin ...	9 12	9 10	8 10	17·3	16·9	16·5
Average (Four Centres) ...	10 2	10 4	10 4	17·6	17·4	17·2

On the average there is practically no difference in the yield of the crops grown on drills of different widths. The average sugar content of the crop grown on 18-inch drills is slightly the best and the roots grown on 21-inch drills show a somewhat better return in this respect than those grown on 24-inch drills.

Singling of the Plants to different distances apart.

Plots on which the plants were singled to 8 inches and 12 inches apart, respectively, were again laid down at each centre. The general arrangement of the sub-plots is shown in the plan facing page 115. Apart from the singling of the plants to different distances apart, the crop on these plots was treated in exactly the same manner as the crop on the plots in the "width of drills" test, conducted at the same centres. The results of these trials are shown in Table XI.

TABLE XI.

Centre.	Distance apart of Singling.	Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
		18-Inch Rows.	21-Inch Rows.	24-Inch Rows.	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.
		T. C.	T. C.	T. C.	%	%	%
Athenry ...	8 inches ...	10 10	10 10	10 13	17·1	17·4	17·0
Ballyhaise ...	8 inches ...	9 8	10 5	8 0	17·5	18·4	17·4
Clonakilty ...	8 inches ...	10 15	10 19	9 15	17·6	17·0	17·4
Glasnevin ...	8 inches ...	10 17	10 15	8 0	18·1	17·6	17·5
Average (Four Centres) ...		10 8	10 12	9 2	17·6	17·6	17·3
Athenry ...	12 inches ...	10 10	12 10	9 0	17·1	17·1	17·0
Ballyhaise ...	12 inches ...	8 12	9 9	8 12	18·2	18·3	18·4
Clonakilty ...	12 inches ...	10 5	10 3	9 15	17·7	17·1	17·2
Glasnevin ...	12 inches ...	11 5	9 0	9 11	17·1	17·3	17·6
Average (Four Centres) ...		10 3	10 6	9 5	17·5	17·5	17·6

On the plots where the drills were 18 inches and 21 inches in width, slightly better average yields were obtained where the plants were singled to 8 inches instead of 12 inches apart, but where the drills were 24 inches wide the reverse was the case. As regards sugar content very slight differences were shown in the average returns from the different series of plots.

Singling at Different Stages of Growth.

In 1925, 1926 and 1927 a series of experiments was conducted at either three or four centres in each year to determine the effects, on the yield and sugar content of the beet crop, resulting from the singling of the plants at three different stages of growth. Full particulars in regard to the plan of these experiments, together with the results obtained in 1927 and the conclusion drawn from the returns for the entire period of three years, were published in the Department's Journal, Vol. XXVIII., No. I.

Whilst better results were obtained where the plants were singled at the stage when they had developed four rough leaves than where the singling

was performed at either an earlier or a later stage of growth it was considered desirable to obtain more definite data in regard to the effects of early singling. For this purpose a series of experiments was again conducted at four centres in 1928, as shown on the plan facing page 115. On one plot at each centre the plants were singled when they had developed two rough leaves and on an adjoining plot when they had developed four rough leaves. Save that these plots were singled at different stages of growth they received exactly the same treatment.

The results in regard to yield and sugar content are shown in Table XII.

TABLE XII.

Centre.	Yield per Statute Acre (Factory Weight).		Sugar Content of Roots.	
	Plants singled at two-leaf stage	Plants singled at four-leaf stage	Plants singled at two-leaf stage	Plants singled at four-leaf stage
	T. C.	T. C.	%	%
Athenry	12 0	10 14	17·5	17·4
Ballyhaise	9 0	8 12	18·0	18·3
Clonakilty...	10 8	10 13	17·5	17·3
Glasnevin	10 8	11 5	17·3	17·4
Average	10 9	10 6	17·6	17·6

It will be observed that on the average of the four centres there was practically no difference between the yields from the crops singled when only two rough leaves had developed and from those singled when four such leaves had grown, and that the crops had the same sugar content.

Experiments at the Munster Institute Farm.

A trial was again conducted at this centre to determine the effects of different quantities of superphosphate on the yield and sugar content of the beet crop. On land which in the previous two years was in grass three adjacent plots were set aside for this experiment. Plot I. received the standard dressing of artificial manures consisting of 4 cwt. superphosphate (35%), 4 cwt. kainit and 1 cwt. sulphate of ammonia. Plot II. received a similar dressing plus an additional 2 cwt. of superphosphate (35%). Plot III. was dressed in the same manner as Plot I, but, in addition, an extra 4 cwt. of superphosphate (35%) was applied. None of the plots received farmyard manure in preparation for the beet crop. The Kuhn (P) variety of

seed was dibbled in at intervals of 9 inches, in 21-inch drills, on all plots and the general cultivation of the crop was the same as that prescribed in the case of the variety experiments conducted by the Agricultural Instructors.

The leaves of the plants on Plot III. which received the heaviest dressing of superphosphate (8 cwts. per statute acre) commenced to ripen about a fortnight earlier, but less uniformly, than those on Plots I. and II. In other respects there was no difference in the appearance of the crop on the different plots. Particulars of the yield and sugar content of the beet on the different plots are shown in Table XIII.

TABLE XIII.

No. of Plot	Manuring per Statute Acre.			Date of Sowing.	Date of Singling.	Date of Lifting and Weighing.	Yield per Statute Acre (Factory Weight).	Sugar Content of Roots.
	Superphosphate 35%	Kainit.	Sulphate of Ammonia.					
	cwt.	cwt.	cwt.				T. C.	%
I	4	4	1	16 May	15 June	3 Nov.	14 8	16·5
II	6	4	1	do.	do.	do.	13 0	17·8
III	8	4	1	do.	do.	do.	12 3	17·1

The results of this experiment are somewhat irregular but, taken in conjunction with the returns from similar tests carried out at this centre in 1927 and other trials conducted by Agricultural Instructors in 1926, 1927 and 1928, they show that under normal conditions exceptionally heavy dressings of phosphate have very little influence on the ripening of the crop or in increasing the yield obtained. In fact in some instances a heavy dressing of superphosphate has decreased the yield.

III.—OTHER EXPERIMENTS.

Experiments in the Storing of Sugar Beet.

Soon after the Beet Sugar Factory at Carlow commenced operations in November, 1926, it became obvious that beet growers in this country would, in many cases, find it necessary or desirable to store beet temporarily before delivery to the factory. The Department, therefore, instituted two series of experiments in the winter of 1926 for the purpose of ascertaining the extent of the changes which occur in the weight and sugar content of beet roots and in the purity of the juice, when sugar beet is stored in much the same manner as mangels are usually stored in this country.

At each of the Department's farms at Athenry, Ballyhaise, and Clonakilty, during the month of November, about 3 tons of properly crowned and washed sugar beet was weighed carefully and stored immediately thereafter in a clamp. The clamp at each centre was 4 feet high, relatively narrow and long, and was covered loosely with a layer of wheaten straw approximately 6 inches in depth. At the beginning of the following February, after the roots had been in storage for approximately 10 weeks, the entire quantity of roots was again weighed in order to ascertain the loss in weight. At the beginning and the end of the period representative samples of the roots in each clamp were tested for sugar content and for purity of juice. In the winters of 1927 and 1928 this experiment was again carried out on similar lines at each of these three centres.

At three centres in the vicinity of the Carlow Sugar Factory experiments were carried out, during the winter of 1926-'27, in order to determine the rate of loss in weight and sugar content of beet when dumped from a cart on a headland in a continuous heap and covered loosely with a 6-inch layer of straw, *i.e.*, the method which was at the time most favoured by farmers for the temporary storage of beet. At each centre a cart load of beet was made into a clamp resembling a section of a heap as described above, and in the centre of each clamp were placed a number of samples of roots taken *in each case from one portion of the field and* specially selected for uniformity of size and shape. Each sample consisted of 10 roots, which were enclosed in half-inch-mesh wire netting after they had been carefully crowned, trimmed, washed and weighed. The sugar content of one sample from each clamp was determined when the clamp was made and other samples were tested at the end of each fortnight over a period of 8 weeks. When each sample was withdrawn from the clamp it was re-weighed to determine any alteration in weight, and at the end of the period the loss or gain in weight and percentage of sugar which had occurred in respect of all the beet in the clamp during each fortnight were calculated from the weights and analyses of the different samples. In the winters of 1927 and 1928 these experiments were repeated with slight modifications. In 1927 somewhat larger clamps were made at 4 centres. In 1928 four clamps were made at one centre and the number of roots in each sample was increased to twenty.

In 1928 the Irish Sugar Manufacturing Company, Limited, co-operated by affording the necessary facilities for carrying out a more elaborate experiment than those conducted at different centres in 1926 and 1927. The object of this experiment was similar to those conducted in the previous two seasons and, in addition, it was decided to test the effects of different methods of covering the clamps as well as to study the causes of variations in losses resulting from the storing of beet, which had been revealed by the results obtained in previous years.

~~It is gener~~ally accepted that in order to conserve the maximum amount of sugar in stored beet, the conditions of storage must be so controlled that the water content of the beet is kept normal; that on the other hand the beet is under optimum conditions for growth and respiration when it contains its normal amount of water; that those processes tend to consume the reserve

of sugar in the beet, but that this difficulty is overcome by subjecting the beet of normal water content to a low temperature. The fulfilment of the above requirements for the storing of beet under field conditions would appear to be limited chiefly to a choice of the site, the covering, and the size of the clamp. The experiments at Carlow in 1928 were, therefore, designed to compare the effects of covering clamps of beet with straw, with beet tops and with a more impervious covering which, for experimental purposes, consisted of a heavy cloth extending over the side of the clamp and beneath a light layer of straw. The effect of the situation of the clamp on losses in the weight and sugar content of beet was tested by placing two clamps in a sheltered position and two others in an exposed position.

Owing to slight mishaps, the returns from all the centres where experiments in the storing of beet were carried out in 1926 are not comparable, and these experiments may be regarded as preliminary in nature. The average returns for the two years 1927 and 1928 in respect of sugar beet storage trials carried out at the Department's farms and the similar trials conducted in County Carlow are shown in Table XIV.

TABLE XIV.

RESULTS FROM EXPERIMENTS IN THE STORING OF SUGAR BEET CONDUCTED DURING THE TWO SEASONS, 1927-'28 AND 1928-'29.

Year.	Centre.	Number of Clamps.	Period of Storage.	Average Rise or Fall in percentage of Sugar in Roots.	Average percentage of Loss in Weight of Roots.	Average percentage of Loss in Weight of Sugar.
			days	per cent.	per cent.	per cent.
1927-'28	Department's Farms.	3	70–80	+ 0·3	— 6·7	— 5·0
1928-'29	Do. do.	3	73	— 0·7	— 3·0	— 6·8
1927-'28	Carlow ...	4	42	— 0·7	— 4·6	— 6·8
1928-'29	Do. ...	4	56	— 0·5	— 2·1	— 5 3

The experiments to determine the effects of storing beet under different conditions are being continued. The results so far obtained indicate that, in the case of beet stored over a period of 8 to 10 weeks in the ordinary narrow clamp covered lightly with straw, there is a decrease of sugar amounting to approximately six per cent. of the total weight of sugar in the beet.

ENSILAGE FROM BEET TOPS AND WET PULP.

"Beet tops" are the crowns, together with the adhering leaves, after the roots have been severed at the point where the lowest leaves have grown. "Wet pulp" is the residue of the finely sliced beet roots after the sugar

has been extracted from them. Beet tops and wet pulp form two valuable feeding stuffs, either in the fresh state or when made into ensilage. The sugar factory at Carlow is equipped for the drying of the entire output of wet pulp and the demand for the Company's "Sugar Pulp," which is prepared by mixing wet pulp and molasses and artificially drying the product, is such that very little of the pulp is sold in the wet condition. Beet tops, however, are a by-product on the farm and the profits derived from beet growing in Continental countries are said to depend, to no small extent, on the use which is made of this by-product. In those countries it is the general practice to feed beet tops as much as possible during the period when the crop is being harvested and to make ensilage of the surplus. Occasionally the tops are ploughed in as a green manure, but they are not regarded as having as high a value for this purpose as for feeding to cattle and other live stock.

In order to obtain definite information in regard to the making of beet-top ensilage in this country, experiments were carried out at the Department's farms at Athenry, Ballyhaise and Clonakilty in 1926 and 1927 and at Athenry in 1928. The experiments at Athenry and Clonakilty in 1926 and 1927 consisted in the making of ensilage from tops varying in quantity from 4 to 13 tons in the fresh state.

At each centre a pit was dug approximately 2 feet in depth, 4 feet in width, and of sufficient length to contain the quantity of tops available, when the heap was built to a height of 4 feet from the level of the bottom of the pit. Provision was made for the drainage of the pit, and the beet tops were packed firmly therein when in fresh clean condition. The top of the heap was covered with a thin layer of grass, and over this was spread a layer of soil. When the heap had subsided the top was rounded off with an additional layer of soil and the sides of the heap were banked with soil. After the lapse of a period, varying from 3 to 4 months, the entire contents of the silo was weighed and divided into sound and unsound ensilage, according to its appearance. The palatability of the sound ensilage was then tested by offering it to different kinds of live stock.

The experiments at Ballyhaise in 1926 and 1927 were carried out on the same lines as those at the two other farms with the exception that wet pulp was mixed with beet tops in nearly equal quantities, and a thick layer of wet pulp instead of soil was placed on top of the heap.

At Athenry, in November, 1928, approximately 13 tons of fresh beet tops were stored in a small wooden silo. The tops were well trampled until subsidence ceased. A considerable quantity of liquid drained from the silo. At the end of two months when the silo was opened the contents were so decomposed that stock would not eat it. Results not quite so unfavourable were obtained at this and the two other centres in previous years, but in no case were the results regarded as economic or even encouraging. The proportion of the output which appeared to be suitable for feeding purposes was at all centres relatively small and when offered to live stock it was either consumed sparingly or refused altogether.

As results similar to the above have been obtained in a number of cases where beet growers in this country have attempted to make ensilage from

beet tops and wet pulp, it is evident that the making of ensilage from beet tops involves considerable risk and it will generally be found more economical to feed them in the fresh condition.

The Effect on the Sugar Content of Checking Growth by Severing the Taproot before Harvesting.

Sugar beet does not ripen so rapidly or decisively in this climate as in warmer and drier countries. It has been proved by experiments in this country that under ordinary favourable conditions the growth of sugar beet continues at a very slow rate throughout the winter months. Growth increases perceptibly, and is usually accompanied by a reduction in the sugar content of the root, during periods of warm wet weather, which occur frequently during the winter months.

An exceptionally high sugar content, obtained in the winter of 1927 from beet which had been lifted with a plough but had been left otherwise undisturbed in the land for a period of fully one month thereafter, drew attention to the possibility that this treatment may have increased the sugar content by almost completely checking the growth and thereby promoting the ripening of the plants. At another centre, in the following winter, a plot of beet was treated as described above and the results of repeated analyses showed that the percentage of sugar was invariably greater in the treated beet than in similar beet which had not been so treated.

Accordingly, in the autumn and winter of 1928 a series of 14 similar trials were conducted at six centres in four counties. The percentage of sugar in the beets was increased in every case where the roots had been severed by running a lifting plough under the beet some time before the roots were pulled and crowned. The interval between the date of severing the roots with the lifting plough and the date of harvesting varied at the different centres from 7 to 57 days. The additional increase in the percentage of sugar in the treated beet as compared with that in the untreated beet was, in nearly all cases, at the rate of quite 0.25 per week, the average increase being slightly above that amount. At one centre, however, where the soil was a light loam and the beet plants had a ripe appearance the average rate of the additional increase, in trials extending over 8 weeks, was only half the above rate per week.

These trials are being continued.

SUMMARY OF THE RESULTS OF THE PRINCIPAL EXPERIMENTS WITH SUGAR BEET CONDUCTED IN THE YEAR 1928.

(1) The average returns from the two varieties Kuhn (P) and Klein-Wanzleben (Z), as compared with corresponding returns from a strain of each of these varieties, which was expected to produce a heavier crop of roots containing a lower percentage of sugar, shows that the two strains of Kuhn seed, Kuhn (P) and Kuhn (Pa), are almost if not quite the same as regards yield, percentage of sugar in roots,

and general appearance. The two strains of Klein-Wanzleben seed, however, differ considerably in these respects and, whilst the (E) strain of this variety produced the better yield this result was counter-balanced to a considerable extent by its lower sugar content.

(2) In the manurial trials conducted by the Agricultural Instructors the standard dressing of artificial manures consisting of 4 cwt. superphosphate (35%), 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre, applied immediately before sowing the sugar beet seed, gave quite satisfactory returns as compared with the results obtained from certain modifications of this dressing; but the application of an additional 25 per cent. of the standard dressing gave a profitable increase in the average value of the crop per acre.

(3) A dressing of sugar factory waste lime at the rate of four tons per statute acre applied to the land in the autumn or winter before beet was grown, increased very slightly the average yield and sugar content of the crops. The results of these trials indicate that a dressing of waste lime may produce a profitable increase in the returns from the sugar beet crop when the soil is in need of lime, but that the use of burnt lime may in some cases be more economical on account of its more concentrated nature and the greater ease with which it can be handled and distributed over the field.

(4) The results of experiments in the storing of beet indicate that, in the case of beet stored over a period of 8 to 10 weeks in the ordinary narrow clamp covered lightly with straw, there is a decrease of sugar amounting to approximately six per cent. of the total weight of sugar in the beet.

(5) It is evident that the making of ensilage from beet tops, either alone or when mixed with wet pulp, involves considerable risk of loss and that it will generally be found more economical to feed the tops in the fresh condition.

SUMMARY OF THE RESULTS OF THE MANURIAL AND CULTIVATION EXPERIMENTS WITH SUGAR BEET CARRIED OUT IN EACH OF THE YEARS 1926, 1927 and 1928.

(1) The time of the year at which farmyard manure is applied for the sugar beet crop, *i.e.*, whether the manure is ploughed in during winter or is applied in the drills immediately before the seed is sown, does not appear to exercise any appreciable influence on the shape of the roots produced or on the value of the crop as determined by its yield and sugar content.

(2) A dressing of artificial manures consisting of 4 cwt. superphosphate (35%), 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre applied immediately before sowing the sugar beet seed gives quite satisfactory returns as compared with the results obtained from certain modifications of this dressing. No benefit appears to be derived from the application of the phosphatic and potassic manures in winter instead of in spring.

(3) The best results as regards both yield and sugar content are obtained where the drills were 21 inches or less in width, and where the plants are singled to, approximately, 9 inches apart.

(4) Better results are obtained where the plants are singled at the stage when they have developed four rough leaves than when the singling is performed at either an earlier or a later stage of growth.

NOTES AND MEMORANDA.

Extract from "Norway, a monthly review of Norway's selling, buying and shipping," February, 1929.

THE PRESENT AND FUTURE SYSTEM OF THE GRAIN TRADE OF NORWAY.

By OSKAR JAHNSEN,
Director of the State Grain Business.

In the course of the current year—1929—probably from July 1st—the new system with regard to the grain supply of the country, as established by an Act of June 22nd, 1928, will go into effect. The present arrangement will then have been in force for two years. Under this arrangement the State is under an obligation to buy all home-grown wheat, rye, and barley which is suitable for consumption, besides 15,000 tons of oats. For wheat, rye, and barley the State pays a price which is 4 ore per kilo* over the price of first-class imported grain, delivered at Norwegian ports, and for oats a fairly corresponding and slightly varying premium. Under the present arrangement, furthermore, a Government subsidy has been established, granting 4 ore per kilo for home-grown grain utilized in the household of the producer, up to 200 kilos per annum for each member of the household. The importation of wheat, rye, and barley is free, but the importers are obliged to take over whatever quantities of these articles the State has been obliged to buy under the above regulations, the quantity to be taken over by each importer to be calculated according to a fixed percentage of the entire imports, and at a price corresponding to that paid for first-class imported grain c.i.f. Norwegian ports. The importation of oats is prohibited, but import licences may be granted when necessary.

The new arrangement establishes a Government monopoly for the importation and sale of imported grain and flour of wheat, rye, barley and oats. Furthermore, the purchase of all home-grown grain, suitable for consumption, and offered for sale, will still be compulsory on the State, but as far as oats are concerned, the quantity *may* for the present be limited to 15,000 tons.

The premium to be paid for home-grown grain over the price of imported grain under the new arrangement has not been stipulated at any fixed figure but will be based on the Monopoly's sale prices for the products in question, according to regulations agreed upon. The premium, on the basis of conditions as they are to-day, would amount to about 3 to 4 ore per kilo. Roughly speaking, the system will, therefore, be similar to the temporary monopoly established during the war and in force until 1927.

The various arrangements which have been made for the grain supply of the country, and which have now, as will be seen, resulted in the establishment of a permanent monopoly, have all been due to the clear recognition by the people—irrespective of political party—of the necessity of ensuring the grain supply of the country in case of war. A number of committees and commissions, which have dealt with the question ever since 1905 and onwards, have expressed as their opinion that the ensuring of grain supplies must be

* Equal to about ½d. per kilo of 2·2 lb., or approximately 2s. 4d. per cwt.

based first and foremost on an increased home production of grain. To bring about a sufficient increase, however, home production must in some way or other be given the benefit of the State's support. And this support must at any rate be fully equivalent to the protection enjoyed by the other trades of the country. A number of proposals have been made as to the manner in which this might be brought about. Of late years the controversy has been not so much about the amount of the support to be granted by the State as about the way in which the State should offer its support and the manner by which the necessary means for the subsidy should be obtained. Under the present arrangement these means have been obtained from a duty imposed on whole and ground wheat. This duty, however, was abolished as from July 1st, 1928, except for a small duty on wheat flour for the protection of the Norwegian mills, and the cost of the subsidy for the present year—July 1st, 1928, to June 30th, 1929—is, therefore, included in the general taxation. For the future—under the permanent monopoly—the extra price paid for home-grown grain will be an item in the expenditure of the Government Grain Business, as was the case under the previous temporary monopoly.

How, then, does the present subsidy system with free import work, as compared with a monopoly, as far as the importation of grain and flour are concerned? The import of flour has increased since the abolition of the temporary monopoly, at the cost of grain. The re-adjustment, however, has not been very remarkable, the Norwegian mills having been able to keep up their position very well. Several new constructions, as well as extensions of old plants, have been carried out during the past couple of years, so that with the exception of a small part of the wheat, we shall now be able to grind all our flour at home. Even if, for various reasons, some flour will be imported under the new monopoly, we may count on a decrease of the import of flour again, in favour of grain.

The change from rye to wheat, which has been observable in this country of late years as far as the demand in grain for baking purposes is concerned, has been especially remarkable lately. The abolition of the wheat duty and this year's low wheat prices have helped to bring this about, and even if a change in the relative prices of rye and wheat may retard the development to some degree, the probability is that in the long run it will continue.

The following figures covering imports will show the situation of the last three years as compared with that of 1913:—

	1913.	1926.	1927.	1928.
	Tons.	Tons.	Tons.	Tons.
Wheat	22,204·7	89,299·7	95,421·5	98,828·0
Wheat Flour ...	67,532·3	58,936·3	69,261·3	72·050·2
Rye	190,817·2	186,219·5	180,127·3	136,642·9
Rye Flour ...	52,993·1	151·6	9,113·1	13,016·8

The falling-off in the total imports of 1928 is owing to very heavy imports during the latter part of 1927, so that 1928 was begun with exceptionally large stocks. This, however, has gradually been adjusted, as will be seen by the above.

Consumption of Margarine in Denmark.

Whilst the average consumption of butter per head of the population is only about 13·2 lbs. in Denmark—pre-eminently a butter country—the consumption of margarine is no less than 46·4 lbs. per head. In no other country does such a condition of affairs prevail. The reasons for this big consumption of margarine must chiefly be sought in the organisation of the Danish dairying industry, for the co-operative creameries, which handle 85 per cent. of the milk produced in Denmark, take over as a rule all the milk produced by their members, as the individual farms have now no dairy attached to them, or even a churn on the premises. If butter is required, it must be bought at the creamery, but this causes a shrinkage in the milk-money, and so butter is only bought in small quantities for festivals or the like. Otherwise, substitutes such as margarine, which costs only one-half as much or less, are used. The large consumption of margarine in Denmark is, therefore, not due to widespread poverty, but to an economic sense in the relatively well-to-do farmers. The following table shows the manner in which the production and consumption of margarine have developed in Denmark. The amounts are given in millions of kilos. (1 million kilos = 982 tons approx.).

Year.	Production.	Import.	Export.	Total Consumption.
1910	31·0	1·3	—	32·3
1920	55·8	0·4	2·3	53·9
1925	70·2	1·7	0·2	71·7
1926	69·6	2·2	0·3	71·5
1927	71·8	2·0	0·2	73·6

Exportation of Eggs from Poland: New Regulations.

The Polish Official Gazette recently published an Order relating to the sorting and packing of eggs for exportation. The Order, which came into force on 1st February, 1929, provides that eggs intended for export shall be graded in six classes, as follows. The weight in each instance is the weight of 1,000 eggs.

Class I.	45 - 48	kilos	(about 99 to 105·6 lb.)
II.	48 - 51	,,	(,, 105 to 112·2 lb.)
III.	51 - 54	,,	(,, 112·2 to 118·8 lb.)
IV.	54 - 57	,,	(,, 118·8 to 125·4 lb.)
V.	57 - 62	,,	(,, 125·4 to 136·4 lb.)
VI.	over 62	,,	(,, 136·4 lb.)

In each class, not more than 3 per cent. of eggs of lower weight are tolerated. An egg is considered to be fresh which, in spring and summer, has an air-space not more than 7mm. in depth, and not more than 10mm. in depth during the rest of the year. Spring and summer are reckoned from April to August. Eggs are considered fresh only when they have undergone no preservative treatment, are free from specks inside, and contain a sound yolk barely distinguishable from the white. Eggs which cannot be deemed bad, but which do not fulfil these conditions, are graded

as seconds (" Sekunda "). Preserved eggs are graded according to the rules which apply to fresh eggs, whether they are cold stored or preserved in lime.

Export eggs must be packed in dry, clean, odourless cases which must be made of strong, sound boards, having a slightly planed face. In warm weather, there must be a space of at least 1 or 2cm. between the parallel boards. In winter, the cases must be stout and lined with paper; they must be from 155 to 182cm. in length (about 5 to 6 feet), 50 to 56cm. in width (20 to 22 inches), and 25 to 28cm. in depth (10 to 11 inches). Flat cases may be 13 to 14cm. deep (about 5½ inches) if they fulfil the other conditions. Where fillers of cardboard are used, the depth of the case depends on the number of fillers. Full-sized cases should hold 1,000 eggs, flat cases 720 eggs. Cases with cardboard fillers hold from 180 to 360 and from 600 to 720 eggs, according to the number of fillers. Chaff, wood-wool or fillers are allowed as packing material. All such material must be clean, dry and odourless. The weight must be stated on the case. Cases containing eggs less than 45 kilos in weight are marked with the letter " M "; those containing preserved eggs are marked " Sekunda "; and those containing cold-stored eggs are marked " Frigor."

Cases containing cold-stored eggs weighing less than 45 kilos per 1,000 must be marked " Frigor M "; those containing lime-preserved eggs bear the word " Calc " and the grade weight; those containing lime-preserved eggs under 45 kilos the 1,000 eggs, the inscription " Calc M," and finally, those containing fresh, but dirty, eggs must bear the letter " D." On the front of the case are given: the number of the case, the stamp or identification mark of the exporter, the foreging particulars about the eggs and the word " Polska " (Polish). The marks must be in blue for fresh and clean eggs, in black for soiled or " Sekunda " eggs, and in red for eggs under 43 kilos per 1,000.

Inspection is carried out by special officials nominated by the Chambers of Commerce, and approved by the Ministers of Commerce and of Agriculture It is done in the places where the eggs are stored and packed, but eggs in course of transport may also be inspected if there is any suspicion of malpractice. Exporters who violate the regulations are subject to penalties and may be struck off the list of registered export firms.

Austrian Order Prohibiting Importation of Potatoes from France.

An Order (26th Jan., 1929) has been issued by the Austrian Ministry of Agriculture, prohibiting the import and transport through the country of potatoes, tomatoes and egg-fruit as well as packing-material and refuse of such tubers and fruit from France.

This prohibition does not extend to the importation and transit of the above-mentioned articles from Corsica or the French Colonies, provided that in both cases the consignment does not touch French soil in course of transit, nor does it extend to dried goods and preparations such as dried potatoes, potato flour, tomato conserves and such like commodities.

The Order came into force on 15th February, 1929.

Standardising the German Egg.

A determined attempt is being made at present in Germany to capture at least the home market for German eggs. Statistics prove that in 1928 some 3,000 millions of foreign eggs, valued at about £15,000,000, were imported into Germany. The average number of eggs laid per hen in Germany is only 80 per annum, as compared with Denmark's 150. Nevertheless, Germany considers that with 62 million laying hens, she should be capable of supplying the home market at least.

Some time ago, the German Agricultural Council proposed the use of a national stamp on German eggs. This stamp shows an egg in an egg-cup, bearing the letter " F " and the words " Deutsches Frischei.' (German Fresh Egg.) The German Agricultural Council has handed over the administration of the stamping regulations to the Co-operative Egg Societies throughout the country. These, acting in conjunction with the Chambers of Agriculture, have drawn up a set of rules for the use of the national, or " unity," stamp, as it is called. The co-operative and other egg societies which use the stamp must pledge themselves to avoid all misuse of it and to assist the controlling official by every means in their power. Every month a return of the number, kind and value of eggs delivered must be furnished to the Chamber of Agriculture. In order to qualify for the stamp, eggs must fulfil the following conditions:—

1. They must be uniform as regards size and weight and must have been tested by the lamp. They must not have been laid more than seven days and must be clean and unwashed.

2. The stamp, which must be applied to the larger end of the egg, must indicate the place of origin. From March to August, inclusive, it must also indicate the actual month.

3. Packing must be in accordance with certain rules, and eggs must be graded by weight as follows:—

Size 1. Over 60 grammes (2 oz. approximately).
Size 2. Over 55 to 60 grammes (1·9 to 2 oz. approximately).
Size 3. Over 50 to 55 grammes (1·7 to 1·9 oz. approximately).

Eggs weighing less than 50 but not more than 43 grammes may be stamped only during the period September to December. They may not receive the " Unity " stamp. Chipped, broken, abnormal, blood-stained or discoloured eggs may not be stamped.

Result of the Swiss Grain Referendum.

The referendum taken in Switzerland on the 3rd March, 1929, resulted in a majority of over two to one in favour of the acceptance of the Federal Assembly's scheme for maintaining the country's wheat supply and controlling the import grain trade. The whole farming community, both the wheat-growing lowlander and the stock-breeder in the higher Alps, stood solidly for the measure, which found considerable support also in the towns.

The victory is regarded in farming circles as the best solution of the present agricultural crisis. Three questions were put to the electorate to be answered by either " Yes " or " No." (1) " Do you wish to have accepted the Popular Initiative which demands that an Article (23bis) be inserted in the Constitution ?" The Article proposed in the Popular Initiative in question would have had the effect of rejecting the principle of the grain monopoly, while recognising the need for encouraging the home production of wheat. The Federal Assembly asked the people to reject this proposal. (2) " Do you wish to accept the counter-proposal of the Federal Assembly for assuring the national wheat supply ?" The electorate were invited to answer " Yes " to this question. (3) " Do you wish to accept the Federal Law of 27th September, 1928, which amends Art. 14 of the Customs Tariff Law ?" The force of this amendment would be to increase the tax on statistical forms (invoices, etc.) used in connection with foreign trade, thus providing funds for the proposed national grain scheme.

As already mentioned, the result of the referendum has been to throw out the Initiative and to accept the alternative suggestions put forward by the Federal Council. Their scheme contains three main proposals, namely: (1) With a view to insuring the national food supply, the Confederation shall maintain a sufficient supply of wheat. They shall be empowered to oblige millers to store wheat and to take over wheat reserves. (2) The Confederation shall promote the home cultivation of bread-corn and shall support self-supply. They shall take over good home-grown grain suitable for milling at a price which will render possible the home cultivation of cereal crops. (3) The Confederation shall take steps to maintain the native milling industry, while protecting the interests of the consumer of bread and flour. To this end, they may impose import duties upon foreign flour, or reserve to themselves the right to import flour. They may, if necessary, grant special facilities to mills in remote districts with a view to equalising the higher costs of transport, and may help to defray the cost of transport of flour supplies in mountain districts.

Bacon Production in Russia.

According to a report published in the " Economic Review " of the Soviet Union, the production of bacon in Russia is developing rapidly. Bacon is the principal item in the list of Soviet meat exports. The number of pigs handled at the bacon factories during the first quarter of the season, October-September, 1927-28, reached 176,000 as against 228,000 handled during the whole season 1926-27. From 1924-25 to 1926-27 the number of pigs handled in bacon factories increased almost seven-fold. Nevertheless, the production in 1926-27 was still only 42 per cent. of the capacity of the factories. By next year it is expected that the capacity of Soviet bacon factories will be about 700,000 pigs and that production will amount to 70 per cent. of the total capacity, or approximately 500,000 pigs, which will yield 60,000,000 lb. of bacon. Within the next three years eight more factories are planned.

The State meat marketing organisation is engaged in a campaign of spreading information among the peasants as to the correct methods of breeding swine. Hundreds of peasant co-operatives for this purpose have been formed.

The number of pigs in Russia in 1927 is variously estimated to be from 20 to 22 millions, which is about the number kept in 1916. Exports of bacon, elmost exclusively to the British market, reached 16,634,000 lb. in 1926-27.

French Experiments in Controlling Potato Wart Disease.

A report on the researches into the control of Potato Wart Disease carried out at Russ (Lower Rhine) in 1928, states that sulphur and copper sulphate applied in 1927 had an always pronounced but often disastrous effect upon the growth of the next year's potatoes. It would thus seem that these disinfectants should not be used, since they control the disease only when applied in doses which affect the growth of the potato.

Attempts at disinfection with formol were also made. This was applied at the rate of 1½ litres of formol per square metre, either diluted in 18½ litres of water, or mixed with 35 litres of water, which latter quantity ensured the thorough saturation of the soil. The first treatment was given early in April, and a second one a fortnight later, but only to one-half of the plot already treated. After each of these treatments, half the surface was covered with bituminised cardboard.

Potatoes were set in the disinfected plot on 11th May, or 24 days after the second treatment, and the bituminised cardboard was left in position until the autumn. The report in this case was as follows:—Vegetation good; tuberisation satisfactory in all cases; a certain proportion of tubers were attacked. The preservative effect of the formol, though distinct, was inadequate, and the cost of treatment was excessive."

Thus, no practical method for destroying wart disease in ground intended for potato-planting is at present available. The sole means of fighting the disease consists in the use of resistant varieties, of which a large number are now known. Efforts are being made to obtain resistant hybrids suitable for French requirements.

Pork Production in Holland.

According to a recent report by the Danish Consul General in Rotterdam, the profits obtained from pig fattening in Holland are exceedingly uncertain. Though pig prices have on the whole maintained an even level, maize prices at the close of the period under review were again rising sharply. The index figures for the three most important feeding grains were as follows for the last two months of 1928 and January of 1929:—

	Maize.	Rye.	Barley.
November, 1928 ...	167	135	119
December, 1928 ...	167	133	115
January, 1929 ...	170	134	117

Unfavourable reports have been received from the various Dutch provinces, with the exception of Northern Brabant and Limburg, where satisfactory results have been obtained by the extensive use of potatoes as feeding for pigs.

There has been less diminution in the total number of pigs, and an increase has even been noted in all groups in the province of S. Holland. This would indicate that fatteners are anticipating better profits in the near future. Bonhams, too, have been making good prices on the whole.

The following figures show the changes in the numbers of pigs in percentages of their numbers at the same date last year. The figures in brackets show the corresponding percentages as shown in the report for 29th October, 1928. The reduction in the number of sows in pig, for the whole country, is estimated at 10 per cent (15 per cent.), of bonhams 15 to 20 per cent. (15-20 per cent.), of store pigs 10 per cent. (15 per cent.), of pigs for salting 10 per cent. (15 per cent.), of animals for renewal of stock 5 to 10 per cent. (15-20 per cent.), and of fat pigs 5 per cent. (20 per cent.).

The Sugar Beet Crop in England and Wales, 1928.

Preliminary figures for the 1928-29 beet sugar manufacturing campaign have been received by the Ministry of Agriculture and Fisheries. The area under sugar beet, as shown by the Agricultural Returns for 4th June, 1928, was 175,736 acres, a reduction of 21 per cent. on the 1927 acreage. This fall in acreage may be attributed in the main to two causes:—

(1) The reduction in the grower's price consequential on the reduced rate of subsidy.

(2) The poor average crops obtained in 1927 as a result of adverse climatic conditions.

Only one new factory—at Brigg in Lincolnshire—was erected in 1928, the total number of factories in operation being 18.

An improved yield per acre, 7·8 tons as against 6·5 tons in 1927, counteracted to a great extent the lower acreage, and resulted in the total quantity of beets delivered to factories being about 1,374,800 tons as against 1,449,152 in the previous year. The average sugar content was 17·32 per cent. as against 16·12 per cent. in 1927. The higher sugar content improved the factories outturn of commercial sugar, which is estimated to have been 3,900,000 cwts. as against 3,651,620 cwts. in the 1927-28 campaign, or an average of about 2,500 lbs. per acre of beet under cultivation as compared with 1,838 lbs. in 1927.

Climatic conditions in 1928 were on the whole favourable to the crop, except for a spell of cold and dry weather at the end of April and the beginning of May, which retarded germination and early growth. Harvesting was carried out under satisfactory conditions, and resulted in the beet deliveries being much cleaner than in the previous season, the average tare being 14·5 lbs. per cwt. as against 20 lbs. during the previous campaign.

The average price paid for beets under the contract was about 51s. 9d. a ton compared with 55s. 6d. in 1927, the decrease being due to the reduced basic price consequent on the fall in the rate of subsidy.

About 97,000 tons of dried pulp and 11,000 tons of wet pulp were produced during the 1928-29 campaign compared with 88,000 tons and 15,000 respectively in the previous one. It is satisfactory to note that over 90 per cent. of the dry pulp was sold for home use as against 75 per cent. in 1927-28. The production of molasses is estimated at 1,010,000 cwts.

The World's Sugar Supply, 1928-29.

The Bureau of Agricultural Economics, Department of Agriculture, Washington, report that the world's sugar supply for the year 1928-29 exceeds that of the previous year by about 10·6 per cent. The only countries which show a noticeable decrease are Czechoslovakia and Russia. The former is the greatest exporting country in Europe, but the small crop produced there this year is more than counterbalanced by increases in Germany and Poland. The decline in Czechoslovakia is attributed to a reduction in the area planted with beet. In Russia, on the other hand, the area under beet in 1928 showed a notable increase on the previous year, and a large crop was expected. As things turned out, however, there was a considerable decline in the output of sugar, owing, apparently, to the low prices offered for sugar beets as compared with those paid for potatoes. Had there been no contracts, it is likely that the Russian sugar factories would have been faced with a shortage of raw material.

Italy, normally an importing country, reports a crop of over 422,000 metric tons, which it is expected will suffice for her needs in the current year. France, also a heavy importer, expects a crop which will enable her to decrease her imports this season.

Co-operative Marketing of Farm Produce in U.S.

At a conference of representatives of the United States Department of Agriculture, the State Agricultural Colleges, and the leading agricultural co-operative associations, plans were discussed for affording assistance along educational lines to co-operative marketing associations through the Department's Extension Service. Special emphasis was laid on ways and means of acquainting farmers with sound principles of co-operative marketing and the aid which can be given by county extension agents in presenting such information. These officers have helped mainly through giving assistance to farmers in the organising of marketing associations, the study and location of markets, the grading and standardization of products, and the development of a volume of production sufficient to attract buyers and place the business of such associations on a substantial basis.

There are to-day in the United States 2,500 county agricultural agents and assistant agents. In their work they have the advice and assistance

of 62 State specialists in agricultural marketing. One thousand county home demonstration agents working with farm women are giving aid in the disposal of surplus garden, orchard, dairy and poultry products, through egg circles, "curb markets," and community and county associations. The business done by all associations and individuals receiving assistance from extension agents in 1927 amounted to 240 million dollars, or nearly 50 millions sterling.

New Zealand Seed Importation Regulations.

Regulations under the Seeds Importation Act, 1927, provide that imports into New Zealand of cocksfoot, lucerne, white clover, or any other seed subject to the provisions of the Act shall be stained in the following manner:—(1) Not less than 1 per centum of each package shall be stained prior to importation with a red colouring matter. (2) The colouring matter used shall be either an alcoholic solution of saffranin or a specially prepared and effective fluid seed-staining dye. (3) Staining shall be done by mixing 1 per centum of the bulk with the stain and then blending the stained parcel with the bulk lot. Certificates, in duplicate, must accompany each imported shipment of the above seeds. Import is permitted only at the following ports: Auckland, Wellington, Lyttleton, Dunedin, Port Chalmers, and Bluff.

Queensland Dairy Industry Compared with that of other Countries.

The Secretary of the Queensland Co-operative Dairy Association, Mr. W. T. Harris, has been making a tour of some of the older dairying countries, including Canada, Great Britain, Saorstat Eireann, and Denmark. Although he found some methods and ideas which he considered worthy of adoption, the general impression gathered was that "Queensland can hold her own against the world so far as the dairying industry is concerned." Mr. Harris travelled through England, Scotland, and Ireland. He remarks that "the growth of the industry in Ireland is remarkable. The value of her exports to England last year was £4,000,000, and she will be a serious competitor with Denmark for that trade. The quality of the Irish product has improved out of all knowledge."

Speaking of Denmark, Mr. Harris says: "I found that the factories were not better equipped than our own factories. The best butter is exported to London, and yet the average Dane eats margarine instead of butter, because of its relative cheapness. Denmark is a remarkable little country, and herd-testing is carried on methodically. Denmark is producing more butter than ever, and in 1926 her production was 4,200,000 tons of milk, yet dairymen there did not appear to be very prosperous as we in Queensland understand prosperity. They have to spend all their money on foodstuffs and fertilisers. The butter not exported is consumed in the country, but it is an extraordinary fact that the Danes consume four times as much margarine as butter."

Speaking of the London Market, Mr. Harris says that Australia's great butter difficulty there is lack of regular supplies and every effort must be made to remedy that state of affairs. He was not impressed with the advertising campaigns conducted in Great Britain on behalf of Australian butter. In his opinion f.o.b. sales do a great deal of harm. "With such a method of selling, market prices are not maintained at proper levels, and I would advise factories against selling butter f.o.b."

THE FUTURE OF DANISH BACON ON THE ENGLISH MARKET.

In the course of a recent article on the world shortage of beef and its possible reactions on the Danish bacon trade, Mr. Harold Faber points out that the high price of Danish bacon on the English market, coupled as it is with a steady demand for that commodity, may largely be attributed to the recent great decline in England's imports of beef from overseas, more especially from the Argentine. As was recently pointed out by Sir William Haldane, a similar, but even more marked, movement has been taking place in the United States. There, too, the scarcity of beef has been supplemented by a more general use of pork.

The important question for the meat producer is: Will the present shortage be only transitory, or is it likely to last? Mr. Faber believes that it will last for some time, and in support of this view he points to the steady decline in the number of cattle in the Argentine during the past five years or so. The production of fat cattle there for slaughter and export has not paid in recent years, and corn—notably maize—growing has been increasingly taken up. Much of the land formerly under grass and lucerne is now under corn, and farmers are obtaining Government aid to build silos. In Canada, Australia and New Zealand, the number of cattle is also declining. These countries are not likely to have a big surplus available for export, and South Africa will need much time and capital before she can build up a herd of the quality suited to the needs of the English market. The same applies to Brazil and Uruguay. The nett result, says Mr. Faber, is that there is little prospect of England having an adequate supply of beef for many years to come, and he wonders how the British farmer will take the chance now offered to him. The tendency in England has been of late to give up meat in favour of milk production, but the milk supply has now reached the level of consumption. That level, says Mr. Faber, is relatively low, and there are good grounds for starting a campaign in favour of greater milk consumption. This would of course take time, but, on the other hand, the task of developing the home production of beef would encounter two very definite obstacles. The first of these would be concerned with the matter of quality. As Mr. Faber expresses it: "Strange as it may seem in a country which owns the best beef herds in the world, and which supplies the world with bulls of the finest beef-producing breeds, the average quality of English beef is not good. This is due to the fact that there is a sharp line of demarcation between the breeder of pure-bred cattle and the agriculturist or farmer, the tenant of a small holding, who is generally content to buy

a cheap bull at an auction without heeding what breed or mixture of breeds it represents, and without bestowing a thought upon the influence the bull will have upon his descendants, whether for meat or milk. So long as the majority of English farmers act in this way, so long will England's beef production bear a corresponding impress. At the same time, though this is so, beef of the finest quality is also to be found in English and Scottish herds." The second point made by Mr. Faber is that the meat trade in England is badly organised. In the Argentine the sale of offal from the abattoirs is made to cover expenses, and the feeder of the beast gets, so to speak, the whole selling price of the carcase, but in England there is a big difference between the price which the consumer pays for meat and the price which the farmer gets for his beast.

Mr. Faber argues that even if England should in time improve the quality of her native beef and organise its sale on better lines—which he admits is not improbable—a considerable time must elapse before this can be done, and meanwhile the English market will not suffice to supply the people's demand for beef, even at a high price. He sums up his conclusions as follows:—

1. The reduced export (which may be much more reduced in the future) of meat from the Argentine will create high prices for beef in England, and an increased consumption of bacon at good prices.

2. The shortage of beef in the United States, which will absorb supplies from Canada, New Zealand, and perhaps soon from Australia, will serve to accentuate the scarcity of beef in England.

3. The reduced export of meat from the Argentine to the continent of Europe may possibly increase the sale of Danish meat in the South.

4. The great increase in maize-growing in Argentina will probably have the effect of lowering maize prices and will thus render the Danish pig-rearing industry more profitable.

Wheat-Growing Campaign in Italy.

The campaign of 1926-27 carried on in Italy, and known as the "Battle of the Grain," brought in a harvest of 53,291,000 quintals of wheat. This was regarded as rather a disappointing result after all the propaganda and efforts of the Government to increase output, and especially as the area under wheat had been slightly increased and the use of fertilisers greatly augmented. Owing to the appreciation of the lira and the great drop in international prices, the price realised for their crops was not sufficient to compensate the farmers for their outlay. To alleviate the distress the Government immediately took the following steps:—(*a*) A diminution of wages, (*b*) a decrease in the price of fertilisers, (*c*) a systemisation of agricultural credit, (*d*) a reduction of taxation amounting to about half a milliard liras, and (*e*) a fair adjustment of agricultural rents.

The above particulars are taken from the report on the economic situation in Italy in 1928, issued by the Department of Overseas Trade. That report further states that the Italian Government, notwithstanding the disappointments of the past year, are not relaxing their efforts. Farmers are

being encouraged to practise deep ploughing and to use selected seeds, fertilisers, motor ploughs and other up-to-date machinery. Experiments in cereal culture are being carried out, and three hundred sections of itinerant chairs of agriculture have been instituted in the zones in which the culture of grain has the most importance. Demonstration fields for rotation crops number 8,000, and selected grain is distributed to small farmers at reduced prices. Seven "consorzi" and associations for selected seed are subsidised to the extent of 50 per cent. of their working expenses, and to the 900 posts for the mechancial selection of seeds, founded in 1926-27, 700 more will shortly be added.

For the coming season wheat has been planted on 12,500,000 acres, some 66,000 more than in 1927. In 1927, the consumption of (a) phosphatic manures was 12,180,000 quintals, against 15,400,000 in 1926, or a reduction of 21 per cent., (b) nitrogenous manures 1,977,000 (against 2,023,000), and (c) potassic manures 298,000 (against 480,000 in 1926). In the autumn of 1927 the use of fertilisers was said to have decreased by 50 per cent., probably owing to the farmers' losses in the previous season. Their use had, however, begun to increase again for the spring sowings.

Export of Butter from the Argentine.

Before the period of the European War, the exports of dairy produce from the Argentine were relatively small, but the high prices obtained for such products during the war and for a few years afterwards caused a much heavier production of butter and cheese for export. Later, when conditions in Europe became more normal, these exports gradually declined. The following figures show the movement of the butter export since 1903. The amounts are given in kilogrammes, 1,000,000 kg. being equal to 982 tons, approximately:—

1903	...	4,594,952	kg.
1906	...	3,797,693	,,
1909	...	3,381,660	,,
1912	...	3,676,706	,,
1915	...	4,032,021	,,
1916	...	5,831,294	,,
1917	...	10,311,115	,,
1918	...	14,569,798	,,
1920	...	16,623,623	,,
1922	...	24,318,397	,,
1923	...	30,899,164	,,
1925	...	26,099,283	,,
1927	...	21,272,221	,,
1928	...	19,943,695	,,

Of the 1928 export, 18 million kg. went to Great Britain. France took 700,000 kg., Peru 500,000 kg., and Italy 200,000 kg. The balance went to various parts of South America, to the United States, Holland, Spain, Japan and Mexico.

The experimental system of classification applied to export butter which was set up some little time ago by the Ministry of Agriculture is to be continued for the present, pending the working out of a permanent scheme.

Importation of Potatoes into Spain: New Regulations.

The Spanish Government has forbidden the importation of potatoes into Spain unless:

(*a*) they carry a certificate issued by the phytopathological service of the country of origin declaring that the tubers come from a region which for a radius of 20 kilometres (about 12 miles) is exempt from wart disease;

(*b*) they are found on inspection to be free from wart disease by the Spanish phytopathological service.

Farmers' Trip to New Zealand and Australia.

The Committee of the British National Union, 218 Moorgate Station Chambers, London, E.C.2, in pursuance of their policy to organise an annual tour of Empire farmers, have decided to promote a tour to New Zealand, including a brief visit to Australia, in January of next year. The visit has the full approval of the Dominion Government and, so far as New Zealand is concerned, is being operated in conjunction with the New Zealand Farmers' Union. Lord Bledisloe has consented to act as leader of the party, which will consist of 50 British farmers and 15 each from Canada and South Africa. Each contingent will travel independently to Auckland. The tour to New Zealand will cover a period of 34 days, during which opportunities will be given of seeing some of the best farms and live stock, and some of the principal freezing works and co-operative creameries. During the visit an Empire Agricultural Conference will be held, at which will be discussed preliminary details in regard to the holding of a larger Conference of Empire Producers in London at some future date. An interesting programme has been arranged for the Australian portion of the trip, including a short stay in Sydney and Melbourne, and trips to some of the more important agricultural districts in New South Wales and Victoria. Members of the tour will be given the option of returning via the Suez Canal or Canada.

OFFICIAL DOCUMENT.

L. 3303-28.
Thirty-fifth list.

AN ROINN TALMHAIOCHTA

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907, SECTIONS 8 AND 14 (1).

List of names approved by the Department for use in connection with Margarine:—

Brilliant.
Happy Valley.
Justso.
Lexion.
Olymp.

Government Buildings,
Dublin, C.17.
29th June, 1929.

STATISTICAL TABLE.

QUARTERLY AVERAGE PRICES FOR EACH PROVINCE, AND FOR IRELAND, OF CROPS, LIVE STOCK, MEAT, PROVISIONS, &c., for the Quarter ended 31st March, 1929.

PRODUCT.	Leinster			Munster			Ulster			Connacht			Ireland		
Crops—	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Wheat ... ... per 112 lb.	0	10	6	0	10	2	0	11	8		—		0	10	8
Oats (White) ... ,,	0	9	5	0	9	4	0	8	6	0	8	7	0	8	10
,, (Black) ... ,,	0	8	8	0	7	7		—			—		0	8	6
Barley ... ... ,,	0	8	8		—			—			—		0	8	8
Potatoes ... ... ,,	0	5	3	0	6	2	0	2	11	0	4	8	0	4	4
Hay (1st & 2nd Years' Crop), ton	5	8	6	4	16	9	5	2	6	4	10	0	5	1	9
,, (Meadow) ,,	4	3	3	3	4	9	4	6	0	3	13	3	4	1	3
Grass Seed—															
Perennial per 112 lb.		—			—		0	14	7		—		0	14	7
Italian ,,		—			—			—			—			—	
Flax ... ... per 14 lb.		—			—		0	11	11		—		0	11	11
Live Stock— per															
Calves, under 6 months head	3	4	3	2	11	9	2	15	0	3	4	6	2	17	6
Store Cattle—															
6 to 12 months ,,	7	16	0	6	14	6	7	2	0	7	19	9	7	4	0
1 to 2 years ... ,,	11	14	6	11	1	3	10	16	6	12	7	6	11	6	6
2 to 3 years ... ,,	15	14	0	14	10	0	14	5	0	16	2	3	15	2	6
3 years and over ,,	18	6	6	15	6	3 (b)	13	5	6 (b)	18	4	0	17	2	0
Fat Cattle—															
Under 2 years ,,	17	10	6	15	13	6		—			—		16	0	6
2 to 3 years ... ,,	19	6	0	18	6	9	18	11	0	18	2	0	18	14	6
3 years and over ,,	21	4	9	19	19	3	18	18	3 (b)	20	11	9	20	18	0
Cows and Bulls ,,	17	10	6	12	19	3	16	19	3	17	15	0	14	11	6
Springers (Cows and Heifers) ,,	20	9	3	18	6	3	19	11	3	19	11	0	19	7	9
Milch Cows (down Calved) ,,	18	14	0	17	9	6	17	4	3	17	8	3	17	16	3
Lambs, under 12 months ,,	2	6	6	2	12	6	1	5	9 (c)	2	5	6	2	9	0
Store Sheep—															
1 to 2 years ... ,,	2	12	6	2	19	6	1	17	9	2	12	9	2	15	6
2 years and over ,,	3	3	6	1	12	0 (c)	2	10	0		—		2	18	3
Fat Sheep—															
1 to 2 years ... ,,	3	5	0	3	14	9	2	11	6	4	4	6	3	9	3
2 years and over ,,	3	10	0	3	13	9	2	9	6	3	15	0	3	10	0
Young Pigs, under 12 weeks ,,	1	4	3	1	8	9	1	15	0	1	17	6	1	11	0
Store Pigs—															
12 weeks to 4 months ,,	1	13	0	1	17	6	2	9	0		—		1	15	3
4 months and over ,,	2	6	9	2	16	9		—			—		2	13	9
Fat Pigs (other than Sows) ,,	4	13	3	5	6	0	6	0	6		—		5	6	3
Fat Sows ... ... ,,		—			—			—			—			—	
Sows for Breeding ,,		—			—		7	2	0		—		7	2	0
Meat, Provisions, &c.—		*s.*	*d.*		*s.*	*d.*		*s.*	*d.*		*s.*	*d.*		*s.*	*d.*
(*a*) Beef (Live) ... per 112 lb.		45	0		—			—			—			—	
,, (Dead) ... ,,		78	9		—			—			—			—	
(*a*) Mutton (Live) ,,		61	9		—			—			—			—	
,, (Dead) ... ,,		108	0		—			—			—			—	
Pork (Dead) ... ,,	£4	7	0	£3	19	0	£4	2	6	£3	16	3	£4	0	3
Eggs ... ... per 120		15	5		14	6		13	9		14	5		14	6
Wool ... ... per lb.		1	4		—			0	10⅞ (d)		—			1	4

(*a*) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(*b*) Mostly second class cattle. (*c*) Mountain Type.

(*d*) Mostly Unwashed Mountain Wool.

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DEPARTMENT OF AGRICULTURE

JOURNAL

Arterial Drainage (General) in the Irish Free State—The Feeding Value of Old Champion and Lochar Varieties of Potatoes—The Feeding Value of Wheat for Farm Live Stock—Wicklow Mountain Sheep: Their History and Improvement—Experiments on the Control of American Gooseberry Mildew ((1925-1929)—Mole Draining: Report on Trials conducted at Agricultural School, Ballyhaise—Value of the Common Tests for Purity as applied to Irish Winter-made Butter—Notes and Memoranda—Statistical Tables—Official Document.

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CONTENTS.

ARTERIAL DRAINAGE (GENERAL) IN THE IRISH FREE STATE.

(ACTS 1924-1925-1926).

By C. H. Olley, Chief Drainage Engineer—Office of Public Works.

During the past six years, the Office of Public Works has administered the two General Arterial Drainage Acts of 1924 and 1925, and also the Owenmore Drainage Act of 1926. First of all a large number of the existing drainage districts were examined to ascertain their condition, and reports and estimates were prepared. Later, a special Arterial Drainage Section was constituted to continue the operations begun on the old systems; to determine the merits of all new schemes "petitioned" for under the 1925 legislation; and to deal with the Owenmore. The duties of the Section include the preparation for, and the carrying out of, all works approved under the above enactments; and in recent years a staff of over twenty engineers, with other assistance, has had to be employed to cope with the volume of work entailed.

A number of Valuers are also called in as found necessary to deal with the constant assessments necessary to complete approved schemes, but their work is independent of the Engineering side of the Drainage Section.

1924 Act.

The Act of 1924 deals wholly with the old Drainage Districts, and not only empowers the Office of Public Works to restore them to something like their original condition, but includes in addition the desirable authority to make minor improvements where the experience of the past half century has shown that such works will be of real benefit to the lands already taxed under their various awards.

In the Irish Free State there are 173 Drainage Districts constructed under the Acts of 1842 and 1863, and very many of these, on examination, were found to be neglected or seriously deteriorated. Restoration, with more or less new work, was carried out upon sixty-one (61) Districts between 1925 and the Spring of 1929, at a cost of nearly £170,000. These operations cleared, deepened and widened 920 miles of main rivers and tributaries, to the benefit of about 111,500 Statute acres, as scheduled in the original Awards. Widespread employment was given to local labour in 22 counties, and upwards of 2,800 men were under pay during the "peak" or busiest period.

1925 Act.

The new Act of 1925, though similar in principle to the former ones, differs from them in various points of procedure; being intended to suit the needs of tenants and tenant purchasers.

In former times, a Drainage Scheme had to be initiated by the people concerned, and carried out by them, with the assistance of loans from the Government if the scheme was approved. On completion the works were maintained by local Boards, or Trustees, elected by those who benefited.

Under the 1925 Act, any six or more rated occupiers who desire to have a Drainage District formed must Petition the County Council. Should this authority agree, and the Commissioners of Public Works be satisfied as to the merits of the proposal and that the majority of the interested people favour it, they carry out the works, and hand them to the County Council, under a Final Award, for future upkeep. The benefited occupiers pay the costs of construction and of maintenance but the Government and the County Council may assist by free grants.

There are three principal stages, therefore, in the process of forming a Drainage District with which the Arterial Drainage Section of the Office of Public Works must deal:—viz., (1) the preliminary investigation, to ascertain in order to judge the merits of the proposal the approximate cost and the probable amount of damaged land which will be benefited; (2) the preparation of Surveys, plans and calculations with a close approximate estimate of expense for such definite scheme as will improve a quantity of land determined by a Valuer and scheduled in detail by him as a basis of assessment; and (3) the carrying out of the works complete, ready to go to Final Award in Court.

Arterial Drainage.

An ordinary Drainage District may be roughly compared, in general outline, with a tree. The main river from the beginning of the system to the outfall is like the trunk from the top to the ground, increasing gradually in capacity downwards as it receives the accumulating volume of water from the various tributaries, represented by the branches. Or, as a further illustration, the river may be compared to the human arteries and capillaries, the former being the main channels providing the outfalls and the latter the tributaries, into all of which the occupiers can open up their smaller streams. Hence the name "Arterial," exhibiting the essential difference between this class of work and that of "field" or farm drainage, with which it is frequently confused. From the shape and contour of the flooded areas, a drainage district will sometimes consist mostly of main stream or artery, and with only a comparatively short total length of side drains. In other localities the reverse form will occur, and considerable mileage of tributary must be provided to a central channel of no great extent.

Obviously the "merit" of a scheme must largely depend upon the greatest areas of land being benefited by the shortest lengths, and cheapest size, of channel opened through such lands that will effect their due improvement, as the more land benefited in proportion to the expense on works, the better the proposition "pays." It follows that moderate arteries which can be widened and deepened at comparatively little cost will frequently yield more advantageous financial results than would the larger rivers on which considerable sums must necessarily be spent, although

the areas of land the latter damage or inundate are often not much greater mile for mile than the area injured by the former. Furthermore, the wider-spanned bridges and heavier accommodation works required, together with the greater difficulty in ensuring adequate maintenance of the main channel, all militate against the "economic" aspect of draining the bigger rivers, unless with considerable grants in aid.

Procedure.

The usual form of procedure followed in designing and constructing a portion of a river "petitioned" for improvement as an Arterial Drainage District may be thus described:—

A Survey is made, with levels and other data, and laid down in drawings in plan and section showing the main river or "Artery" with the tributary streams and drains it is proposed to deepen, widen and improve, by excavating and forming the channels to proper falls, breadths and sloped sides, capable of passing the intended quantity of flood water. The question of bridges and other accommodation and county works, with mill, weir, sluices, and kindred matters must also be gone into. The lands to be benefited are marked by distinctive colour in numbered lots on the plans, according to a schedule of assessment prepared by the Valuer, setting forth the amount payable yearly by each occupier calculated on the improvement to be derived.

The plans, with a description of the works, an estimate of the cost, and a schedule of assessment and compensation offered (if any) are exhibited in the District for a month for the information of the people concerned. They vote upon the scheme, and according as "assents" or "dissents" (calculated on the existing value of the lands to be improved) turn the scale, the work must proceed or be rejected. Where, however, the voting has been inconclusive, a public enquiry is held, at which doubtful matters are settled and adjustments made, and the results of this enquiry determine the final decision.

When the works are finished the Drainage District is brought to award by enrolment in Court, and no alteration in works or taxation can legally be made thereafter. The Drainage District then passes to the County Council concerned for future maintenance and collection of drainage rates.

Method of Working.

For the restoration or re-conditioning of the existing Districts, on account of the indeterminate and highly variable nature of the clearing required (removal of trees and other growth, levelling hard and soft shoals, widening channels, sloping and strengthening of banks, etc.), and at times the repair or rebuilding of many accommodation works, it has not been found economic or desirable to use other than ordinary tools, while the policy of judiciously spreading manual labour as fully as possible over various counties, has also to be kept in view.

In carrying out works where manual labour is employed, it is a good plan in many cases to proceed with the channel excavations in two

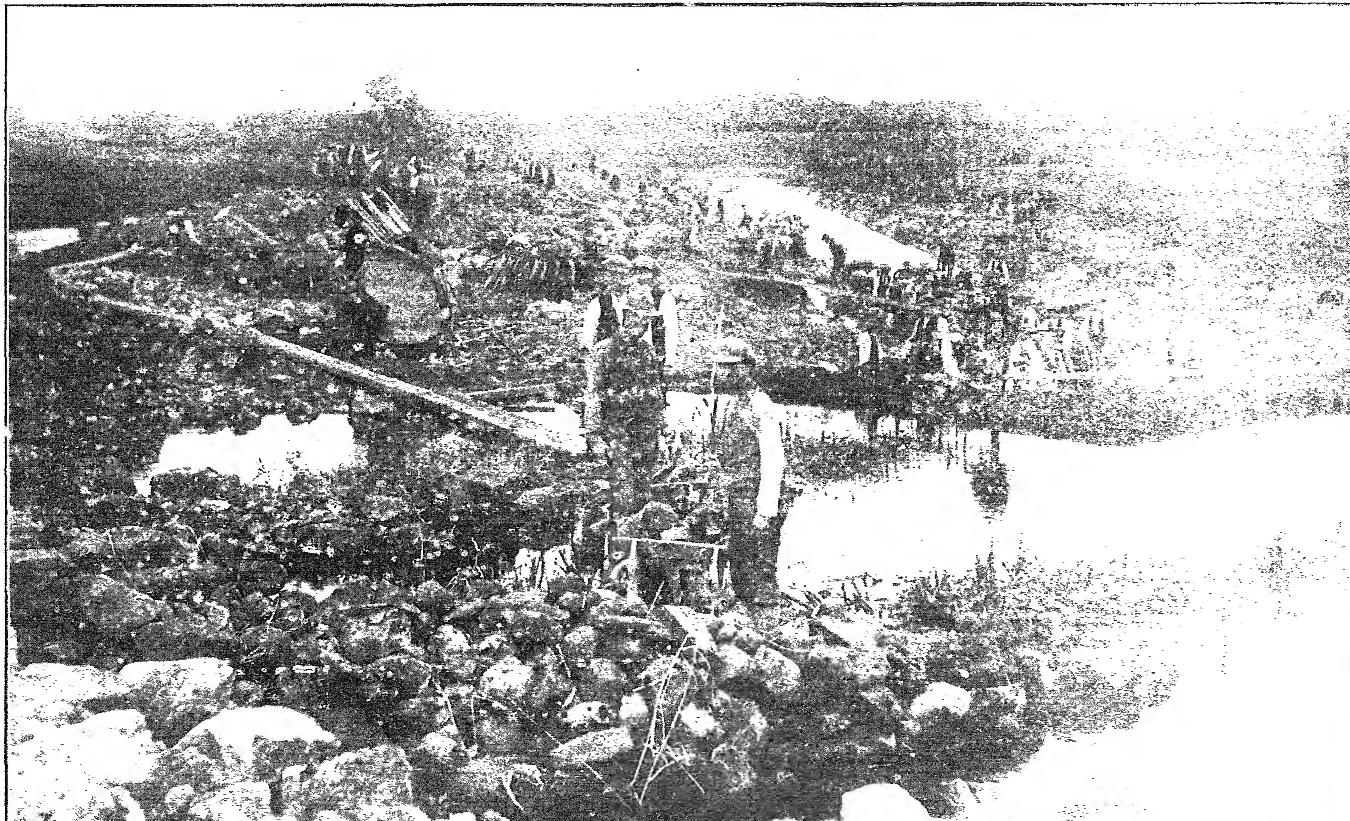
operations. The first is the "roughing out" of the system (especially along the main river and its important tributaries) by pushing the working gangs rapidly from the outfall to the top, removing only the weeds and most serious obstructions, opening narrow sections, and cutting away such bush and growth as more seriously impede free flow. This releases "dead" and surplus water, gives the worst saturated lands a chance to soak out, helps the lateral streams to clear, and generally gets the channel into fair condition preparatory to permanent shaping and grading. Such a preliminary process is specially valuable when a scheme cannot be started till the Autumn, and where it is clear that, in any case, work must economically cease before winter floods begin, and cannot be re-started till Spring. The occupiers get an immediate benefit in a short time, which is often of material advantage to them from January to April.

The second operation, to finish the scheme complete, usually requires laying dry the beds of the rivers and tributaries to a greater or lesser extent according to the season. Main and subsidiary dams of earth, stone timber, etc., are erected, and the water either passed round temporarily through side and "tap" drains, or allowed to accumulate above the dams to such levels as will not injure surrounding lands. Simple hand sluices are fitted in the dams to regulate and run off the impounded water at meal hours, during the night, and at week ends.

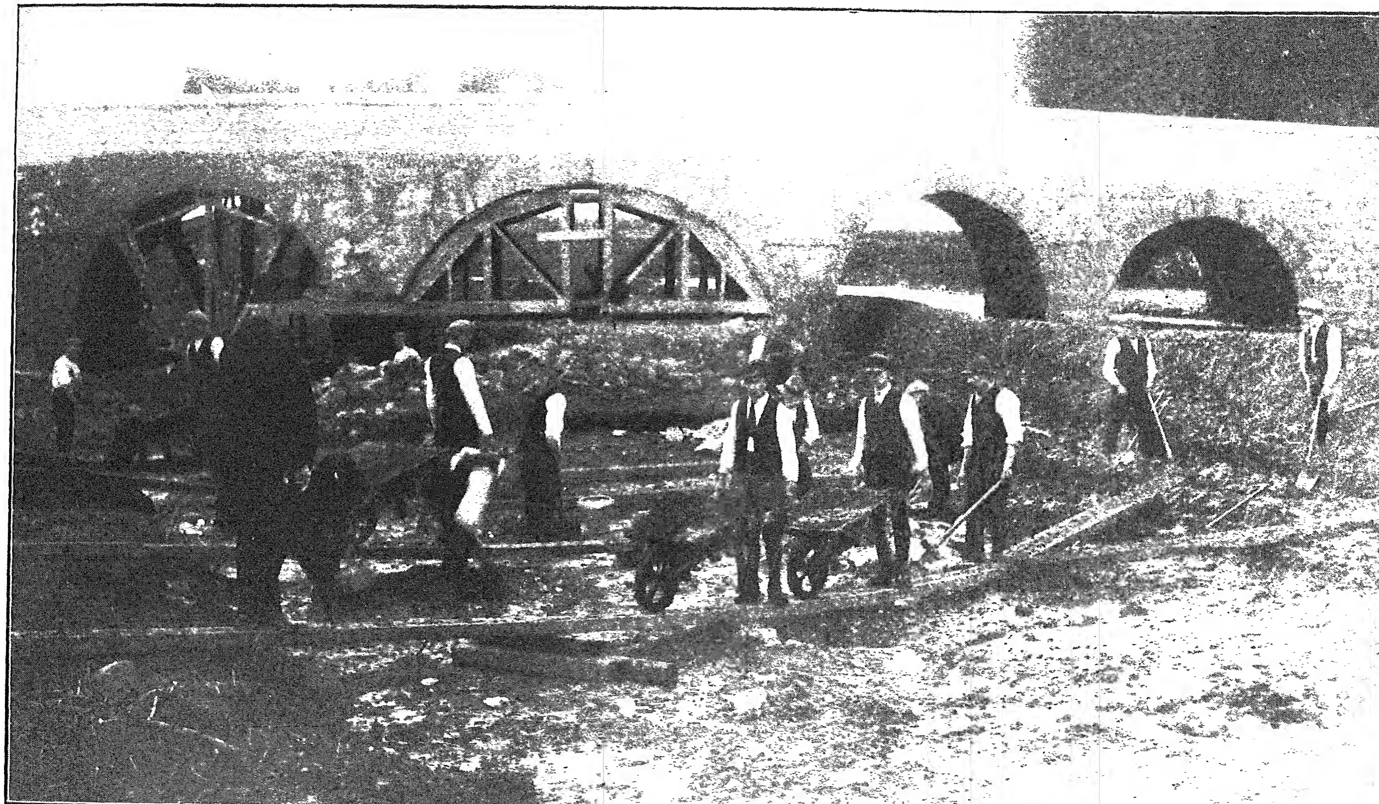
The works are in charge of an Engineer either resident, or inspecting at frequent intervals, as the size and cost of the scheme may dictate. Under him is a foreman, skilled in such work, with gangers and "leading-hands" proportioned to the number of men employed, which varies from 80 or 100 to 500 or 600 as required. but dependent to a great extent on the local labour supply, which is sometimes fully absorbed. Tools are confined as much as possible to the more ordinary and simple kinds such as picks, spades, shovels, slashers, barrows, timber, scrapers, drags, pumps, etc., which are readily procurable and saleable locally at the end of the job. The smaller, though often highly beneficial, works can nearly always be most economically done by such means, and in any event (even on extensive systems) a great part must be carried out in this way. On whatever portion, however, power plant will suit best, or for other reasons is found desirable, it is employed to dig out the heavy excavations closely to depth and shape, leaving the finishing to manual labour when the permanent water has been well lowered in the main channels.

When the restoration works under the 1924 Act were in full swing, with upwards of 18 Drainage Districts in hands at once, employing over 2,000 men, the organising of tool transfer to the various jobs formed an exacting item in the supervision. Partly through district stores and partly by direct transport, the continual movement of tools was carried on. In Winter, storage and repair were arranged for, though several works were kept going throughout the year.

As regards tools new schemes under the 1925 Act are dealt with by another method better adapted to the particular circumstances. While the power plant and larger gear are common to all the jobs the ordinary implements are supplied new to each Drainage and charged to it. On



OWENMORE DRAINAGE (CO. SLIGO).
Damming off old channel and forming new main cut; heavy excavations in boulders and glacial deposit.



OWENMORE DRAINAGE (CO. SLIGO).

Forming new enlarged main channel; and carrying down Piers and Foundations of public road Bridge, to meet altered levels, 5 to 6 feet lower.

completion, these tools are sold by Public Auction and the net receipts are credited to the cost of the district—an arrangement frequently advantageous to the occupiers who must pay their share for the works.

Extent of 1925 Act Schemes.

The provisions of the 1925 Act have been largely availed of by the farmers, and since the passing of it over 600 "Petitions" for new drainage schemes have been received by the Office of Public Works. Of these, almost 400 proposals have been investigated on the ground, and reports and estimates made; the total approximate estimated cost of the works amounting to at least £1,550,000, while the area of lands to be improved is estimated at 200,000 acres. The suggested systems have naturally been of the most diverse character in extent and cost, ranging from cases of simpler channel improvement for an expenditure of a few hundred pounds to those of large and complicated drainage areas involving £200,000 to £250,000 and including such rivers as the Moy, Awbeg, Corrib, Nore, Suir, Robe, &c. It was found more desirable, on consideration of many small petitions, to exclude these from the operations of the Office of Public Works, and, accordingly, the Arterial Drainage (Minor Schemes) Act, 1928, was passed. This Act transferred to the County Councils concerned the obligation of carrying out all drainage schemes estimated to cost less than £1,000.

The cost of Drainage Works is much greater than formerly owing to most of the more suitable drainage areas having been dealt with 70 to 80 years ago, leaving the less likely and economic areas for treatment now; while the charges incurred since those days have been increased out of all proportion by the changed labour conditions. It will need considerable care in the execution of Drainage Works, with the help of Government grants and frequent financial assistance from County Councils, to modify or remove most of the very serious flooding to agricultural lands which still exists in the State; but use of power plant assists in the difficulties.

From the mass of Petitions examined to date and still in hands, it has been found possible to select a number of the proposals as suitable for conversion into drainage systems. Of these, thirteen (13) schemes, totalling a channel length of 114 miles to improve 10,230 acres, are under actual construction in 10 Counties, at an estimated cost of £48,200; twenty-four (24) more with a total length of 237 miles have been prepared to improve 25,064 acres at a cost of £119,800; and a further twelve (12), 142 miles long, are in process of design to improve 14,840 acres at a cost of £73,700—a total to date of 49 Drainage schemes in 18 counties, improving 493 miles of channel, estimated to cost £241,700 and improving 50,134 acres in all. The administration of the Act is necessarily encumbered by many financial difficulties, and tedious negotiation is often involved; hence constructive operations by the Drainage Section have only had time as yet fairly to begin.

Owenmore Drainage.

The provisions of the 1926 Act for the Owenmore Drainage (Co. Sligo) have also been carried into effect. This scheme, originally laid out by

the Congested Districts Board, and just begun by them when the outbreak of the Great War caused its temporary abandonment, eventually passed to the Office of Public Works for re-casting and completion. Started in 1925, it is now finished at a cost of £71,000, for which 26 miles of main river and 50 miles of tributaries have been opened up and remade—a waterway of 76 miles improving some 6,400 Statute acres.

Considerable County and farm works were also required. These included the building of two (2) new Public Road Bridges and the underpinning and repair of twelve (12) others. Also the erection of sixty-two (62) new Accommodation Bridges and the rebuilding of ten (10) others, together with the underpinning of five (5) of this type—a total of ninety-one (91) bridge structures dealt with.

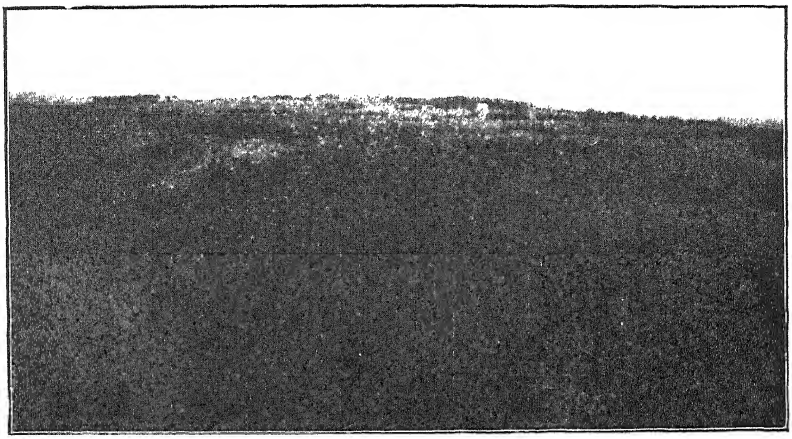
Of the twelve Public Road Bridges underpinned, several involved heavy and risky operations while carrying down Piers and abutments for 5 to 6 feet to meet the levels of the newly-cut channel of the Owenmore. Shoring up the old masonry arches of such bridges while the supports were removed piecemeal from under them, and getting the new work added, was in some cases costly and laborious.

Very flat lands are the feature of the central and upper portions of this Drainage District, and only small falls can be provided to a lake situated midway on the system,—which acts as a Regulator, or impounding reservoir for the flood waters on their way down. In arranging for the execution of the works, circumstances made it desirable to adopt hand labour and all the available men over a wide area of country—from 500 to 600 at times—were kept employed during the full swing of the operations, or in economic proportion as demand rose and fell. The district, being highly subject to widespread inundation in a region of heavy rainfall, required considerable use of power pumping plant. Large quantities of compacted boulders and sand-cemented stones were dealt with, and compressor drills were necessary to break up the river beds and prepare them for blasting. It was necessary to do a considerable amount of rock excavation at the outfall, and through this formation the main river had to be widened by 15 to 20 feet, with side depths of 6 to 8 feet, and upwards of 4,000 cubic yards of rock were blasted and removed at a reasonable cost. The general facilities for traffic over the Owenmore river have been improved within the ambit of the scheme.

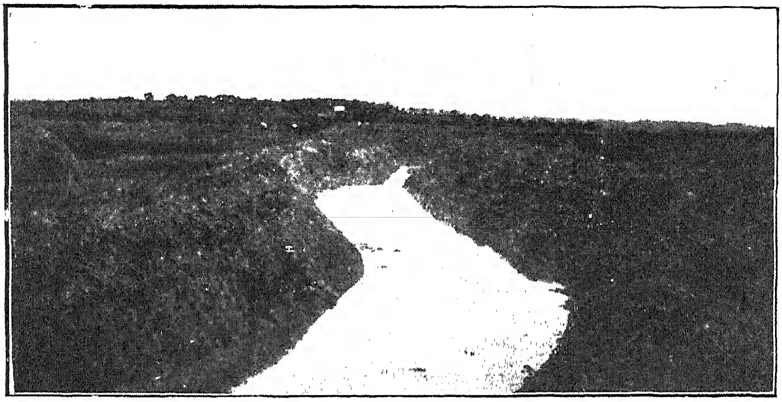
Plant and Gear.

Any description of plant in use at the moment must be of an interim character, and regarded as incomplete, since both the total quantity and the types of gear and appliances to be ultimately employed will vary with the further development of drainage operations and with policy.

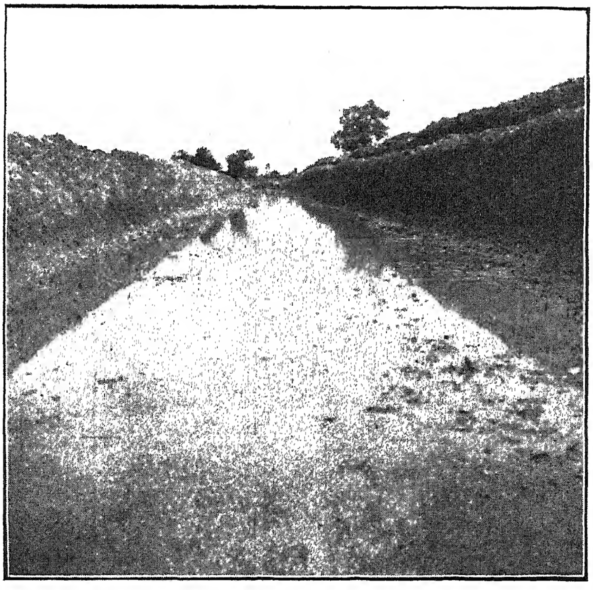
In considering the plant requirements for an Arterial Drainage Section of a Government Department which will operate, to greater or less degree, in all the 26 Counties of the State, and deal with the different conditions arising on every kind of scheme, it is important to employ, as far as possible,



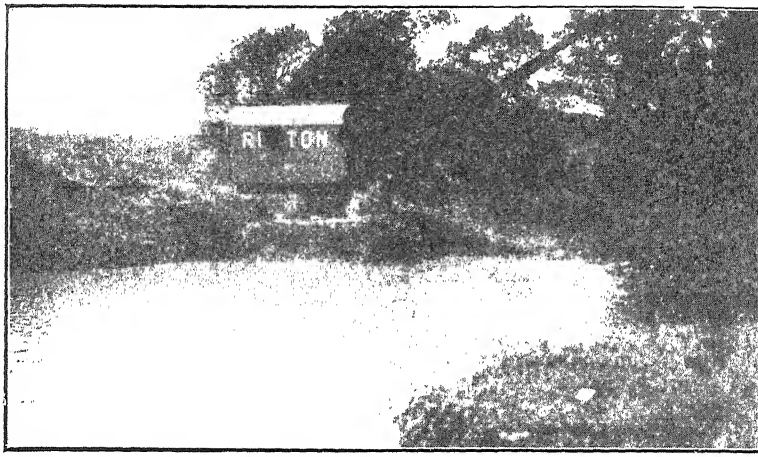
AWBEG DRAINAGE (CO. CORK).
A former "river" in foreground, identified by dense growth winding through lands before excavation began.



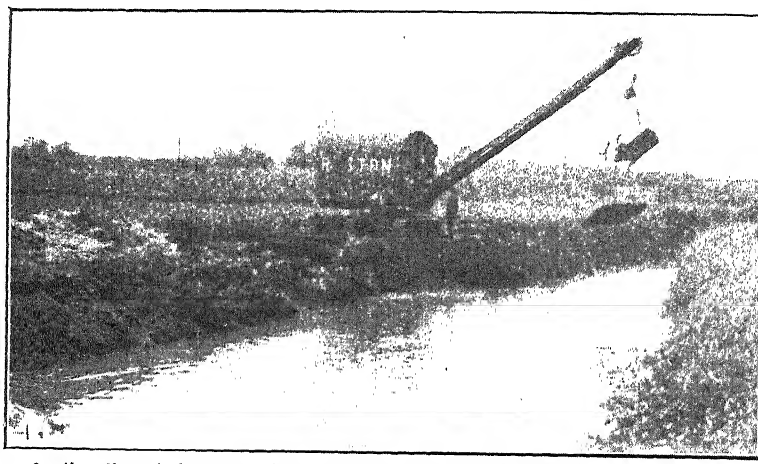
Same place as above, after cutting of new and enlarged channel.



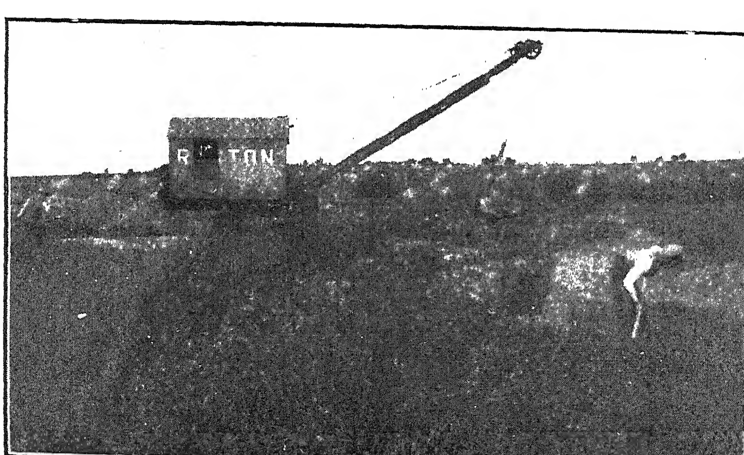
KILMASTULLA DRAINAGE (CO. TIPPERARY).
Restored main channel, cleared of heavy silt and growth; deepened and re-graded.



AWBEG DRAINAGE (CO. CORK).
Excavator forming new channel 30 feet wide. Old river shown in background, highly obstructed and only 8 to 10 feet broad.



Continuation of above new channel further north. River upstream wholly choked and grown in. Excavator shifting portion of its timber " mat " on which it travels along bank.



N.E. division of same Drainage. Excavator commencing new Cuts at densely obstructed old " river."

gear of the standard and most generally useful types only. It must frequently be moved to remote sites difficult of access, and should be of average applicability to jobs small or large, easy or difficult. Specialised fitments or apparatus not likely to be of ordinary all round everyday service are undesirable on the score of economy. Many details in design and execution have to be reasonably standardised, thus tending to ensure interchangeability of plant, with its spare parts and accessories.

The more important plant required, up to the present, can be classed under three heads, viz. :—Excavating, Drilling, and Pumping gear, together with special Grabs and Drags.

The Excavators are five in number, built by Messrs. Ruston & Hornsby (Lincoln), of the Petrol Paraffin " Dragline " type. Careful comparison between this power unit and others of somewhat similar design, in regard to first cost, capacity, etc., for the general work of this Section has not up to date justified purchase of different makes of machine; among other advantages of using only the one type being the ease of stocking and interchanging identical spare parts and fitments. Each Excavator is self-contained, fitted with 35-40 H.P. Dorman Engine and a lattice girder jib, 28 feet in length and working ½ cubic yard buckets with full-circle swing in both directions. Progression is by " caterpillar " tracks. These can be " spragged " by the driver, or a man alongside, to alter the travelling course.

As the machines work in long shifts Summer and Winter, they are provided with ½ K.W. Stuart Lighting Set, working on 110 volts, and including Switch Board with Rheostat, Amp and Volt meters, etc. This provides ample light within the driver's housed shelter for any repairs or observation, as well as for a 250 c.p. flood light in front of the machine,—a sufficiently powerful beam for working purposes. Safety lights on the Excavator's back panels guard against the " black spot " when swinging. Each machine carries its supply of tools, spare ropes, etc., to ensure uninterrupted running.

Spare buckets for Excavators are always at hand and pass to the Works yard for repair and overhaul as wear and tear necessitates, avoiding difficulty on the river bank and undue delay.

These Excavators can be worked by adaptations in the form of a Dragline, a Skimmer Scoop, a Grab Crane, or a Navvy Shovel; and the general requirements have been best met so far by the first two arrangements, especially by the Dragline. This equipment lowers a heavy steel-toothed bucket holding about two-thirds of a ton into the river, when a wire rope drags it along the bottom to the bank next the Excavator, where it is hauled up full and emptied in " spoil " heaps along the banks. Under favourable conditions the operation can be readily repeated, and several bucketfuls lifted and deposited per minute.

When used as a Skimmer Scoop, a different jib is fitted, on which a special scoop or bucket can travel backwards and forwards. The jib is usually laid out flat from the Excavator with the scoop running under it. By pushing the latter forward in rigid line along the ground to be cut, the scoop is filled. The jib is then upreared, the scoop run out to near its

top and all is swung inshore and the scoop emptied. A third type of jib and bucket is attached to the machine when the Navvy Shovel gear is needed. This somewhat resembles the Skimmer Scoop arrangement, except that the jib can be in any convenient position to suit the shovel, or bucket, which travels up and down along it. The Grab works from the same jib as the Dragline, the jib acting like a crane, raising and lowering the Grab to fill and empty.

The machines in working trim weigh about 18½ tons each, and from the nature of the channels dealt with and the general circumstances, floating them on barges has up to the present been found unsuitable and progression by land has therefore been adopted. The methods of manœuvring and travel are organized for varying conditions,—at some places putting the Excavators into the wide shallow bed of the river itself, and at others moving them along its banks. In the former arrangement a firm level trackway is made from the harder matérial lifted, and on this formation special "mats" or platforms are laid to spread the machine's weight. These mats are of beech timber, 12 feet long by 4½ feet wide and about 6 inches thick, specially strengthened against risk of uneven stresses. Each weighs nearly a ton and is slung and moved to position by the Excavator. A Ganger and a few labourers prepare the track and as the caterpillar wheels creep off one "mat" the next is ready for them, each section in turn being lifted and placed ahead as the work progresses, and finally the Excavator digs up the track material behind itself, leaving the bed of the river unencumbered. The machines work in the same manner on the river banks, but in such cases the trackway site becomes part of the "spoil" bank.

The irregularity of marginal lands and their generally soft and saturated condition over long distances, together with the need for the protection of fields when moving the Excavators from place to place, have necessitated the continuous use of timber "mats." The serious risk of heavy plant becoming bogged or upset in treacherous callows having been foreseen from the start, great care is exercised to ensure stability while the Excavators are working, or standing during the night, at week-ends, or while travelling; and up till now, no accident has arisen, nor have any costs or delay been incurred to rectify any serious slip or capsizal.

Material Dealt With.

Very hard material, consisting of massive boulders (ranging up to 3 and 4 tons in weight) and large stones bedded and cemented into sand, have been cleared out at reasonable cost, while blocks of rock as heavy as 4 tons have been shaken from their underlying strata by a Dragline bucket and brought ashore. Severe tests of the kind in a variety of different situations have proved the capabilities of the machines to deal with highly refractory stuff.

This particularly tough deposit may be classed under the geological name of Calcrete. It somewhat resembles, in appearance, the conglomerates or pudding-stones, but there the comparison ends.

Where limestone-debris enters largely into the composition of the superficial deposits, the boulder-and-gravel beds often become cemented into

hard masses by solution and redeposition of lime in the form of crystalline carbonate, through the agency of infiltrating waters. Thus a calcerous concrete, or Calcrete, is chemically produced—pressure playing little or no part in the result.

The Conglomerates, however, are usually bound together by oxide of iron or Silica under immense pressure, and are of great geological antiquity;—while the Calcretes are post-glacial and of relatively recent date,—a period but as "yesterday" in geological time.

In the more ordinary material (clays, sand and gravels with weeds and roots) highly satisfactory results have been maintained, and two machines have removed 475 cubic yards of stuff each on the average per day, in steady routine for over two months at a time. On occasion the Excavators have frequently lifted 500 cubic yards each, in the working day, 11 hours having been found to be an economic period. A cubic yard may be taken, on the average, to weigh about 1½ tons in material such as sand, earth, clay, etc., while solid rock (unbroken) more nearly approximates to two tons.

As channels up to 45 feet wide with slopes have so far been required, the usual procedure is to use a machine on one bank to dig out about one-half of the section for a considerable length, and then to repeat the process on the other bank until the section is complete, using the same machine or a second, according to whichever arrangement is the more economic in time and cost.

Movement of Excavators.

Where Excavators meet bridges over the river, they pass under if possible; if not, they cross the fields to the nearest road and travel back to the working site. The mouths of cross streams interrupting progress are temporarily filled or roughly bridged with requisites carried for the purpose; and when the Excavator passes, these are cleared out and the opening remade. Progression from place to place, both on the fields and public roads, and across the rivers themselves, is readily effected by the "caterpillar" form of traction. When the scope of this method of excavation increases, as more and more schemes are approved suitable for them, the machines will travel from county to county under their own power, or in special railway trucks (on the broad gauge lines) whichever way best suits the general programme.

In shifting positions it is frequently cheapest and quickest to break down fences, insufficiently wide field openings, approaches, etc. (in Army "Tank" fashion) and let the machines get to work at once. The making good the damage for the owner follows; though, in fact, but little trouble or expense of this kind has occurred.

When Excavators are changing site, specially constructed horse bogies are used to convey the mats, buckets, and the like, and this enables the change to be carried out with the least possible harm to the lands, and has proved so far preferable to any mechanical traction.

With five machines, each working an average period of nine months, an approximate quantity of about 200,000 cubic yards has been excavated

between August, 1928, and October, 1929, completely remaking 20 miles of Main Channel, including 24,000 cubic yards from $2\frac{1}{2}$ miles of specially hard formation which alone occupied two machines for about five months; together with about 38,000 cubic yards of similar stuff elsewhere. Flood water has on occasion washed to the driving platform of an Excavator, but no delays have arisen from such cause, nor have any interruptions to work occurred except for ordinary " running " repairs and overhaul.

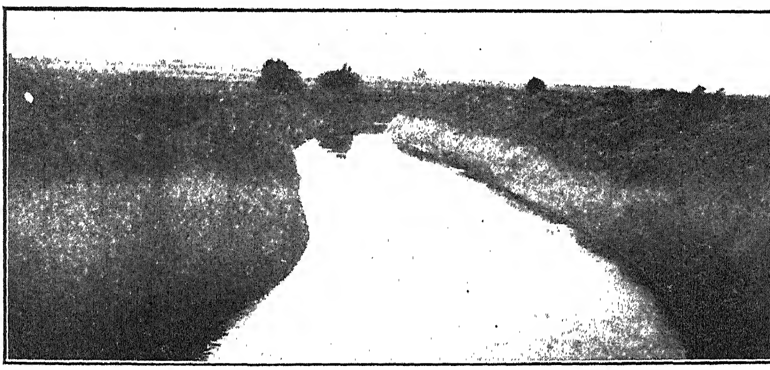
Awbeg Drainage.

Works for the forming of the Awbeg Drainage District (Co. Cork), now nearing completion, yield an interesting comparison between conditions before and after operations on a moderate scheme of the kind. Up till the Summer of last year most of the 20-mile length of old so-called main river (now remade) was little more than a heavily obstructed brook, only capable of passing trickles of water in the drier season and wholly useless as a flood channel after rains. This state continued over considerable stretches of its meandering and twisted course,—which could not be identified at a distance except by a sinuous line of " jungle " growth winding through broad flat lands. Large areas of meadow lay practically " afloat," with dead water standing in the drains a few inches below the level of the surrounding land even in spells of good weather. At a certain bridge 6 miles upstream of a Weir (with a free fall of 10 feet to the lower river beyond) the annual inundations were serious,—river, lands, and public road being covered one to three feet deep in water. The average Winter flood level at this bridge stood practically stagnant (or with hardly perceptible current) 25 feet higher than that of the water passing over the Weir 6 miles downstream. Thus, while there was a difference in the flood heights at the two places averaging about $4\frac{1}{4}$ feet to each mile of river, the mass of water was hanging almost immoveable, being impounded to a long reservoir, and expanded at intervals into a series of lakelets over the marginal lands of the Awbeg for miles. Very many portions of this nominal river were only 6 to 10 feet broad; while loops, bends, continuous shoals, broken down sides, and dense growth completed a state of obstruction by which the natural drainage of the country had ceased for practical purposes.

The whole course within the district—over 20 miles of main and 22 miles of subsidiary channels,—has now been transformed, and a new waterway provided of 10 to 20 feet width at the upper ends and 45 feet wide at the Outfall, with sloped sides and proper falls. Along this, water can pass a few inches in depth, where formerly it stood near the lands, and ordinary floods will be contained within the banks. Similarly on the branches and drains, in proportion. The former floating meadows have already consolidated over large areas, and will provide a safe and improved pasturage where formerly they were impassable and dangerous.

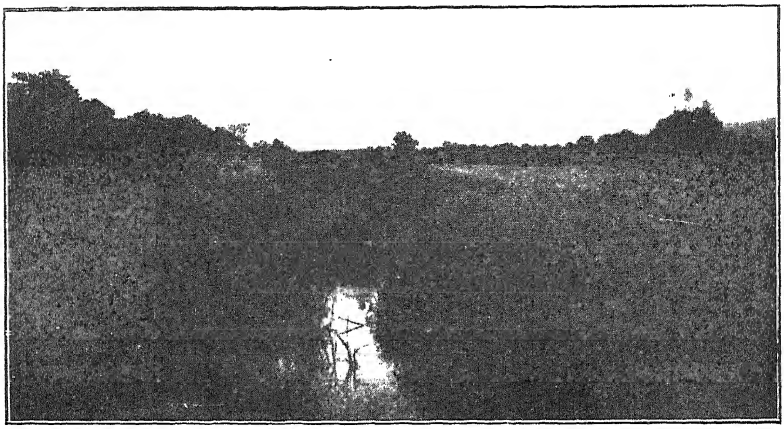
This is a fair example of very efficient improvement to discharging channels made within 16 months of starting work,—and though a definite quantity of land is assessed for taxation on the scheme, there is no reasonable doubt, in the writer's opinion, but that an extra area of the country

AWBEG DRAINAGE (CO. CORK).
Typical Section of a former " river," before excavation began.



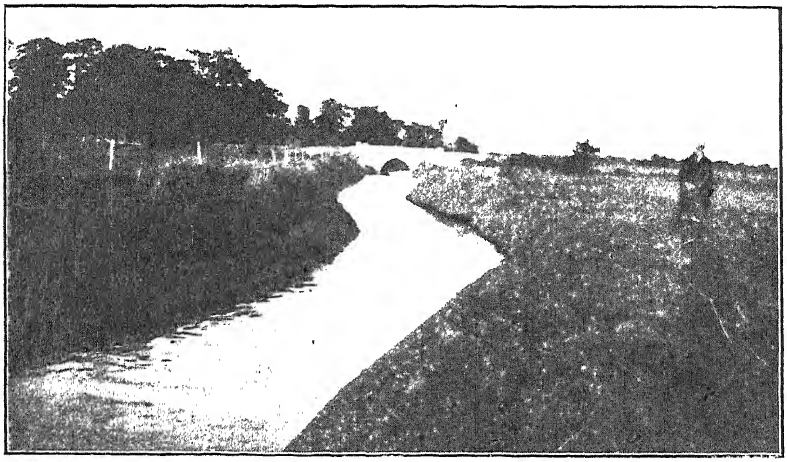
Same as above, after Excavator had formed new waterway.

LOUGH GILL DRAINAGE (CO. KERRY).
New outfall channel, in hard gravels, to Estuary. Covered at high tide, lands protected by automatic sluices built at bridge from which river was taken.

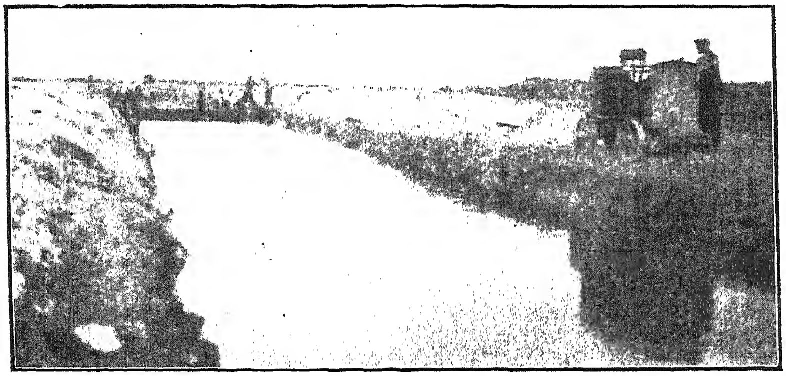


AWBEG DRAINAGE (CO. CORK).

An unimproved "river" before work commenced, little better than a heavily choked drain.



Same place, formed as a main channel, when dealt with by Excavator.



AKERAGH LOUGH DRAINAGE (CO. KERRY).

New outfall channel in rock, stones, and gravel. Main dam in background, with drilling and blasting proceeding beyond.

side must receive indirect benefit,—apart from the opportunity afforded the occupiers to further utilise the new outfalls provided into their property.

In addition to the above excavations, the ancillary works carried out to complete the scheme included one new public road, and twelve extra farm Accommodation Bridges, while six were rebuilt or repaired. Fifteen Railway and Road bridges were underpinned, paved and protected; twenty-one reinforced concrete conduits and sixteen sluices fitted, and forty-eight watering-places for live stock provided,—a total of one hundred and nineteen structures, or an average of three to each mile of river and tributary.

Drilling Plant.

Power plant has, up to the present, been employed on various new drainages, in Counties Sligo, Cork and Kerry, to break and prepare for excavation the large quantities of solid rock, embedded boulders and generally hard beds to be dealt with, including a compact natural formation, or " calcrete," of cemented gravels and stones very difficult to loosen otherwise, and sometimes requiring blasting as already described.

No. 2 and 3 Reavill Portable Air Compressors, direct driven, are employed, the first with an Astor 16 H.P. Engine and the other with an Atlantic Engine of 30 H.P. The drill hammers of " Climax " type are worked by a pressure up to 100 lbs. per square inch and the drills are hollow slot-nosed. Eley patent picks are similarly driven for freeing hard material and boulders, and at times obtain a " face " or opening for the Excavator buckets to penetrate in specially hard material. Power spades further assist to loosen varying tough beds. Considerable lengths of 3-inch diameter armoured hose enable the Compressors to feed air pressure some distance along the river banks, and obviate excessive movement of the heavy gear.

The larger sized plant provides power for three Drills working simultaneously. The smaller Compresser works with two Drills,—a handy and sufficient arrangement for the boring preparatory to blasting hard shoals, often isolated and scattered over long reaches of the same channel. When the holes are ready they are fired by gelignite and time fuse.

Power Pumping has, up to the present, been an important item not only to dry off lengths of river for excavation but to deal with the large amount of underpinning, repairing and paving of existing foundations which occurs on the new schemes, and in the building of Public Road bridges and the construction of Accommodation Works.

Ruston & Hornsby 7½ and 9 H.P. Horizontal 4-stroke Petrol Engines have proved satisfactory, driving by belt on fast and loose pulleys. The former works a No. 3 Pump having 4-inch suction and 3-inch delivery pipes,—the capacity with 10 and 20 foot lifts being 200 and 260 gallons per minute. The larger engine drives a No. 4 Pump with 5-inch and 4-inch piping and delivers 400 and 600 gallons a minute in similar conditions. Each outfit is complete with suction hoses, foot valves, shear legs, Weston pulley blocks, and delivery chutes—all mounted on substantial four-wheeled carriages, which are provided with shafts, and are drawn by horses from place to place, together with the pump on wheels.

Chalmer's Edina horizontal petrol engines of 2½ H.P. are also in use,

coupled direct to pumps with 4-inch suctions, mounted on trucks. These are very portable and convenient for smaller jobs requiring an output of up to 6,000 gallons an hour. Hand pumps and teeming scoops are provided as required.

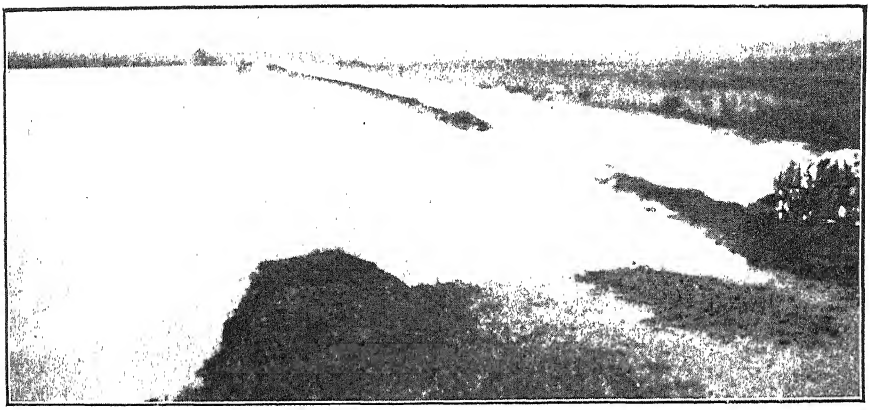
Wells Lights are employed during Winter and overtime work: they are easy to move, and concentrate on particular places, especially at Bridge building, and Rock boring, operations.

Power Cranes run by petrol engines have for some years been in use for the rapid removal of debris from deep rock cuttings in "restoration" works carried out under the 1924 Act: they are now employed on new schemes. Stout box-like buckets (made locally) are let down to the gangs (sometimes 40 to 50 feet below) and hoisted again when filled for emptying on the banks. They are a portable form of plant and well adapted for general utility.

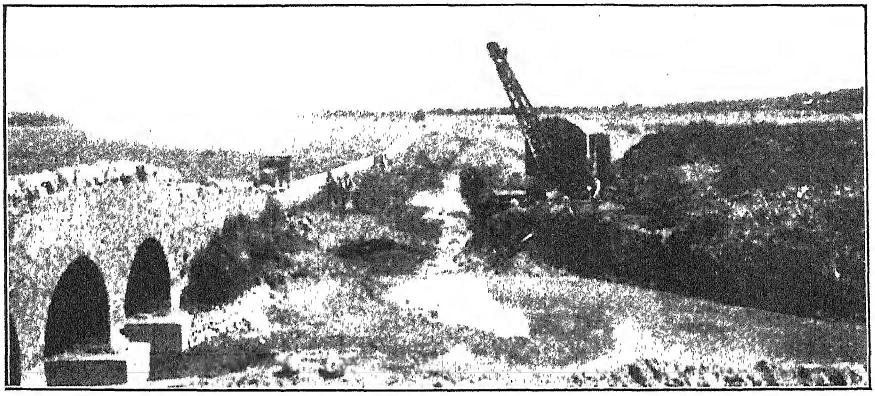
Special Appliances.

Apparatus for the better dealing with certain awkward excavations in clearing and deepening Mill Ponds where Excavators are neither suitable nor economic, either ashore or afloat, have been locally devised and adopted with much success. In one case the reservoir was heavily choked with debris and silt of irregular form and in widths up to 300 and 400 feet, and no letting off of water nor interruption to the working of the Mill was permissible without serious questions of compensation arising. Three shallow flat scoops were made of timber and iron plate so proportioned in weight as to sink fully into the silt bed, and yet capable of being readily raised or lowered as the work required. They were attached together, one behind the other (and about a yard apart) and were fitted with flexible jointed side handles by which men pushed the scoops to the required depths. The scoops were then hauled to the bank by wire rope from a winch fixed ashore. To ensure accurate positions for each dredged cut into the mud and silt, and afford walking space for the men as they managed the scoops and travelled with them to the bank, two narrow gangways of planking were floated in any required direction, eight feet apart, and temporarily fixed in place from the pond bottom. The gangways projected into the reservoir about 220 feet, the necessary and sufficient distance for the particular operations, but had conditions demanded it they could have been continued much further outwards. The Scoops (8 feet wide each) trailed on the bottom, guided between the inner edges of the floating platforms, and were easily kept right to line and level by the attendants. As the shallow buckets were dragged near the bank they slid up an inclined way of timber and were emptied on the lands. By this process about 11,000 tons of material were dug out satisfactorily, and at a cost which compared very favourably with any other method which could be conveniently adapted to the peculiar physical conditions and general works programme at the place.

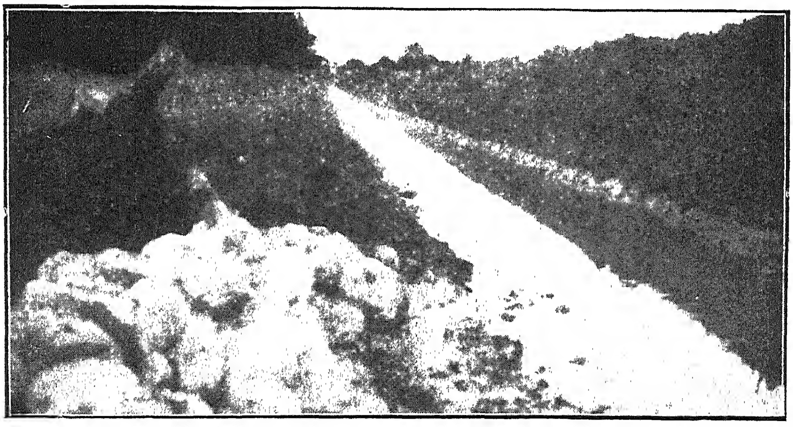
The Gangways, Scoops and hauling gear can, if required, be set and worked to suit almost any position, and at angles to "radiate" from a fixed point over a wide water area—and this method of excavation for



Typical annual inundation (Co. Cork), of lands and public road with old " river " on right. Water over 2 feet deep on road, and widespread flooding to the left. Before improvement.



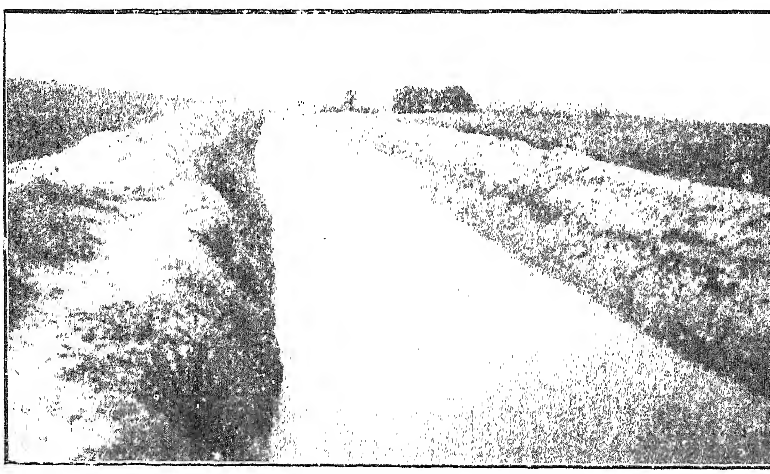
Same place, with flood down; showing public road, and river about to be remade; with junction beside bridge widened and formed.



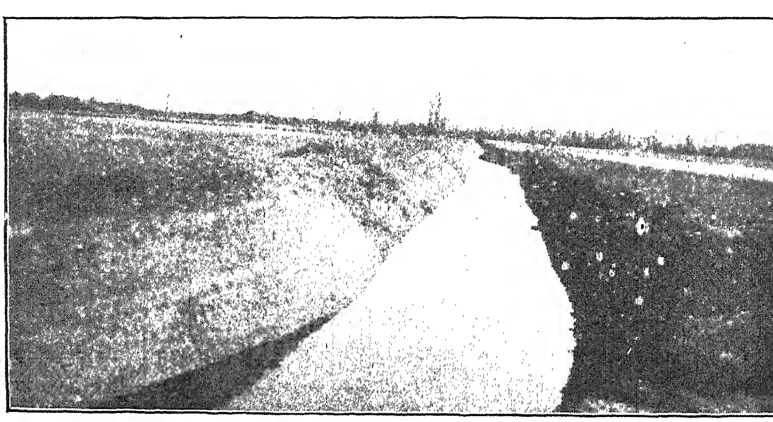
CLONLISK DRAINAGE (CO. OFFALY).

New enlarged channel, in gravels and stones.

AWBEG DRAINAGE (CO. CORK).
Hard calcrete, stones, gravel and rock debris removed by Excavators on lower division, at close intervals for 2½ miles downstream. Blocks, up to 4 tons in weight, shifted and brought ashore.



AWBEG DRAINAGE (CO. CORK).
Near top end of Western division. New channel, with concrete accommodation bridge in background.



Main tributary channel (Co. Cork), replacing shallow and obstructed one.

special jobs will continue to be developed and adapted in different ways and on a larger scale.

Dredger-Drags.

These tools, of varying patterns, have been used occasionally with excellent results in soft channels which could not be dried out at reasonable cost, nor formed economically by power plant on pontoons. Bottoms up to 20 feet and with proper slopes, have been considerably deepened, and remade in two to three feet of water by men working dry shod on the banks, a method used in past years for the removal of intermittent gravel shoals. On these Drainage Districts restorations formerly large-sized dredger-drags or scrapers were successfully and cheaply worked. Their thin iron blades varied from 2½ to 4 feet wide, and were 4 inches to 9 inches deep—some with teeth and others plain. Fitted with handles up to 18 feet long with cross-bars, 6 to 8 men could be put at work on them. A rope from the blade was carried to the opposite bank of the river where a man helped to get the drag out to position, and to regulate the depth of " cut " it could best make while being hauled ashore by the gang. In this way silt banks of sand, fine gravel and growth (sometimes lying across and often down the centre of the river) were removed, and clearance obtained to the old bottom level, beyond which the drainage maintenance law then in existence did not permit excavation to go. When the heaps of stuff came ashore they were shovelled to the bank. Shallow wading enabled the drag-gang to reach out nearly 25 feet from the edge, and by repeating the process from the other side, a river bed up to about 50 feet in width was cleared and shaped while 3 to 4 feet deep of water was passing. The cost came to but a fraction of that necessary to dam the stream—the general circumstances being such as to debar the use of any more complicated or heavy gear.

So much swampy land is constantly met with in excavating drainage channels as to render the weight of an Excavator, for instance, an outstanding consideration in itself. Only the larger rivers can suitably take pontoons to carry the load, while the fact remains that the smaller ones will frequently prove the more profitable to deal with as Drainage Arteries, and on that score must be selected for improvement.

Characteristics of Drainage Schemes.

It is easy to see how the relative proportions of hard and soft materials to be excavated in any scheme will seriously affect its cost; a superabundance of the former (including rock) bringing the total expenditure to several times that of another work very similar in character and size, but where the easy gravel and clay could be readily cut. Hence, certain counties, from their mountainous or irregular contours, and geological character, show up badly in yielding Drainage Districts which can be usefully constructed at moderate cost. Long valley-like areas drained by rivers running over beds of rock or hard glacial deposit, and benefiting

little land, are obviously in a wholly different category from those areas which traverse alluvial and soft soils bordered by wide damaged callows.

Besides this: heavy embanking, a multiplicity of accommodation foot and cart-bridges, tidal and other sluices, new straight cuts, alterations to structures (such as mills and weirs) rebuilding county works, underpinning unstable walls and providing syphons and the like, will largely determine the chances of a scheme's financial success.

Among these items the more frequent are the farm bridges and the sluices; both varying much in size and detail, but as far as possible standardised, or built on the same general designs, in their respective classes. Bridges are mostly of concrete (reinforced and plain) to reduce future upkeep to a minimum; but masonry, steel beams and concrete, in different combination, have to be adopted; while for boggy ground on the smaller channels timber must be used occasionally. A central depôt prepares all the concrete posts and rails required and sends them to the jobs at cost price, a more economical method than casting them *in situ* at each scheme. Other standard fitments are similarly provided.

Tidal and hand sluices are made of pitch pine or oak fitted to the usual forged and cast ironwork; but phosphor bronze details are incorporated in special cases, to increase durability, especially at tidal Outfalls.

Special Restoration Works.

As an instance of how specially heavy works are sometimes called for in the routine restoration of an existing drainage district, the overhauling, clearing and strengthening of a decayed and leaking iron syphon (for Mill-race), under an important river, may be cited as a single item.

Four main embankments were required, each 18 feet high; two to cut off the head race, and two to block the river against upland flood and the highest spring tides. The large compartment thus formed was pumped, the syphon cleared of silt inside and cleaned outside, repaired with plating, and built solidly round in reinforced concrete. New and altered concrete abutments had to be constructed with certain reforming and deepening of the head race. The work occupied about 9 months and cost over £4,000.

Extent and Completeness of Drainage.

Definitions as to what constitutes the necessary, but sufficient, "drainage" of a given area of the flooded land within the rainfall basin, or catchment area of a river, must be open to debate while there arise so many governing, but often conflicting, factors,—all overridden, in the last resort, by a limitation of funds. For instance, a great variety of schemes can be devised for the improvement of a particular number of square miles of water-logged country. They will range from an elaborate provision of numerous and deeply cut rivers and tributaries capable of dealing with almost any floods that conceivably can occur, and practically removing all risk of damage to lands,—down through sets of channels of less and less capacity and cost, each set differing from the last in number, depth, width,

fall, etc., till a limit is reached affording only what may be fairly called substantial improvement.

The ordinary cases will, in practice, obviously lie between the extremes with no hard and fast lines marking the classes above and below. Wise promoters of Drainage Districts will regulate the requirements to the means; and not expect, say, a pound's worth of value given, when only fifteen shillings are available.

County and Mill Structures.

When planning drainage schemes two points frequently arise which, in the writer's opinion, tend to less perfect design than is desirable if due economy to the promoters is to be kept closely in view.

One is in regard to weirs belonging to mills, either derelict, or not working for years. Farmers who suffer from flooding upstream of such places usually exaggerate the damage the weirs cause, and blame them for ill effects far beyond their real influences. They do not realise that the effects of weirs are as a rule purely local, and that if a weir were completely removed the insufficient conditions presented by the river itself would in very many cases, show up as the more important cause of restriction in the discharge. If, however, these useless weirs could be done away with at a small, or nominal cost, no doubt an improved series of falls on the new channels could be sometimes planned,—also getting rid of the cost of building, upkeep, and working of extra flood sluices which frequently have to be fitted to old weirs in the interests of the drainage, at increased expense to the occupiers.

The second point touches the County Authorities. A vast number of small bridges and gullets exist for the passage of the ordinary drainage of the country under the roads, and all experience of Arterial Drainage proves how inadequate many of them are for rapid discharge of floods. As new roads are built, or existing ones improved, insufficient waterways tend to be put in, either repeating the sizes and depths of the former conduits, or of such capacity as may appear to be large enough for new ones by the appearance of the streams, though these are often in a highly obstructed condition at the time, and no criterion of what is required. While County Council funds cannot be unduly expended in providing for remote contingencies not directly affecting the public traffic, still a small additional outlay on conduits, as opportunity occurred, would often be of much utility to the country generally for all time to come.

To meet this particular point of "future drainage" and prevent serious interference with existing waterways by new lines, the Railways Consolidated Clauses Act (1845) requires all bridges, culverts, etc., to be built by the Companies to specified minimum depths, widths, and heights, ensuring adequate discharge of floods not only at the time, but for new conditions that might fairly arise. It would seem that some regulation of the kind might be applied to waterways under public roads.

As matters are at present, the several occupiers on a new Drainage Scheme will often have to pay an appreciable extra cost for improving public

conduits in their own interests, incidentally providing a better or longer-lived structure than existed before,—a benefit to the country at large at the expense of a few individuals. It is suggested that some equitable way out of the difficulty might be found; and the matter is at least, in the writer's opinion, worthy of careful consideration.

The combined results of operations carried out since 1925 to date under the three relevant new Drainage Acts already described amount to an approximate expenditure of £277,000 for the reconditioning or remaking of 1,080 miles of rivers and tributaries in 22 Counties, calculated to benefit about 126,400 statute acres of land.

No such comprehensive Arterial Drainage undertaking to cover the whole of the Irish Free State has been directly set in operation by the Government during the past two generations; and the considerable work already accomplished, together with Schemes in hand and others forthcoming, bid fair to establish a large measure of much needed improvement throughout the country.

THE FEEDING VALUE OF OLD CHAMPION AND LOCHAR VARIETIES OF POTATOES.

In parts of the country where the Old Champion has for years been the principal variety of potato grown, a belief exists that it is of greater value for pig-feeding purposes than most of the more recently introduced varieties. This belief is, no doubt, due mainly to the fact that in this country the Old Champion is considered to be superior in table qualities to practically all other varieties. In consequence, farmers in some districts, particularly in areas where the bulk of the potato crop is used for the feeding of pigs and poultry, have been reluctant to reduce the acreage under Old Champion even though they are prepared to admit that many of the newer varieties are superior as regards yielding capacity and resistance to disease. In other areas where potatoes are grown mainly for export the acreage devoted to the Old Champion has been considerably reduced in recent years.

A series of experiments was recently conducted at the Department's Agricultural Stations at Athenry, Ballyhaise and Clonakilty with the object of securing information on the question as to what extent, if at all, the bias in favour of Old Champion over a heavier yielding variety of admittedly poor table quality tubers is justified. It was decided that Lochar was the most representative of the many varieties at present in general cultivation which are known to be consistently heavy yielders of tubers which, in comparison with Old Champion, are considered to be of poor table quality. Accordingly, it was arranged that tests should be conducted to determine the relative values for pig feeding purposes of the Old Champion and Lochar varieties. Since it was necessary to cultivate an area of the two varieties at each centre at which the feeding experiments were to be conducted in order to provide supplies for the feeding tests it was decided to compare the yielding capacity of the two varieties also. Consequently, it was arranged that equal areas of the two varieties should be grown under similar conditions at each centre and that the produce should in due course be used for the feeding trials. In addition, arrangements were made to have the chemical composition of representative samples of each variety determined each season soon after the crops were lifted and again towards the end of the Winter when the tubers had been in store for some months. The experiment was commenced in 1926 when plots of each variety were grown at the three Agricultural Stations. The feeding and analytical trials were conducted in the following Winter and the tests were repeated on similar lines in a subsequent year.

FIRST SEASON'S TRIALS.

In the Spring of 1926 contiguous half-acre plots of Old Champion and Lochar varieties were planted at each of the three centres. The " seed " of each variety was obtained from County Donegal and as regards preparation of the soil,

manuring, and subsequent cultivation during the growing season both plots were treated alike. In the late Autumn the entire produce of each plot was lifted, weighed, and stored for use in the subsequent feeding trials. The yields per statute acre obtained from each variety are shown in Table I. At two centres ware, and small and diseased tubers were weighed separately while at the Clonakilty centre the total weight only was determined.

TABLE I.

Centre.	Old Champion.			Lochar.		
	Ware	Small and Diseased.	Total	Ware	Small and Diseased	Total
	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.
Athenry	7 10 0	5 1 2	12 11 2	10 5 0	3 9 3	13 14 3
Ballyhaise ...	7 0 0	2 10 0	9 10 0	13 0 0	2 0 0	15 0 0
Clonakilty... ...	—	—	9 16 0	—	—	13 2 0
Average (3 centres)			10·12·2			13·19·0

Comparison of the total yields :—

Old Champion=100. Lochar=131.

It is noticeable that the proportion of small and diseased tubers at the two centres where these were weighed separately is much grater in the case of the Old Champion than with Lochar.

Representative samples of the produce of the two varieties from two centres were submitted for analysis in November and again in January. Owing to an oversight samples were not submitted from the Clonakilty centre. There was little difference in the composition of the samples of the same variety from the two centres or in the samples drawn at the different periods. The average results obtained from the analysis of the four samples of each variety are shown in Table II.

TABLE II.

Variety	Moisture	Oil	Protein	Carbo-hydrate	Fibre	Ash
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Old Champion ...	74·52	·027	1·92	22·3	·61	1·13
Lochar	77·86	·02	1·75	19·04	·52	·8

FEEDING TEST.

In the Winter of 1926 trials were conducted at three centres with the object of comparing the relative values of the two varieties for pig feeding purposes. Pigs of not less than 10 weeks old were selected for the experiment and during a preliminary period of fourteen days they were fed on a mixture of meals and potatoes. The meal mixture used was similar to that subsequently fed

during the experimental period. The same variety of potatoes was not used at all centres but in no case were either Old Champion or Lochar varieties fed. The pigs were weighed regularly during the preliminary feeding period, at the end of which they were divided at each centre into two uniform lots having due regard to age, sex, weight, etc.

During the experimental period both lots at each centre were fed on equal quantities of potatoes and meals. One lot, however, received only potatoes of the Old Champion variety while the other lot was fed on tubers of the Lochar variety. The meal mixture used to supplement the ration of potatoes was as follows :—

Maize meal	...	9 parts
Pollard	...	8 ,,
Meat meal	...	3 ,,

The food was prepared by first cooking the potatoes for each lot separately and then adding the meal mixture in the proportion of one part of the latter to two parts of potatoes weighed before cooking. The pigs in each lot at all centres were weighed individually at the beginning, at the end, and at intervals of a fortnight during the course of the experiment, the weighings being made in each case in the morning before feeding.

The duration of the experiment at each centre was as follows :—

Athenry	...	63 days
Ballyhaise	...	70 ,,
Clonakilty	...	67 ,,

Reports from all centres indicated that the pigs in both lots throve satisfactorily and that no ill health or serious indisposition was at any time observed in the animals under test. It was, however, noticed at all three centres that the lot which received potatoes of the Lochar variety appeared to consume their ration with greater avidity than those in the other lot which were fed on potatoes of the Old Champion variety.

Particulars of the weights of the individual pigs in the two groups at each centre at the beginning and at the end of the experimental period together with the increase in live weight and the average return from each lot at each centre are shown in Table III.

TABLE III.

Centre.	Lot fed on Old Champion.				Lot fed on Lochar.			
	Pig No.	Initial Weight	Final Weight	Live weight increase	Pig No.	Initial Weight	Final Weight	Live weight increase
		c. q. lb.	c. q. lb.	c. q. lb.		c. q. lb.	c. q. lb.	c. q. lb.
ATHENRY.	1A	1 0 7	2 0 7	1 0 0	5	1 0 0	1 3 21	0 3 21
	9	1 0 0	2 0 7	1 0 7	1	1 0 0	2 0 14	1 0 14
	3A	1 0 0	1 3 14	0 3 14	1B	0 3 21	2 0 7	1 0 14
	7	1 0 0	2 0 14	1 0 14	2B	1 0 0	1 3 21	0 3 21
	4	0 3 21	1 3 0	0 3 7	11	0 3 14	1 3 21	1 0 7
	3	0 3 14	1 3 7	0 3 21	2	0 3 21	1 3 21	1 0 0
	5B	0 3 14	2 0 7	1 0 21	6	0 3 14	1 2 21	0 3 7
	12	0 3 14	2 0 0	1 0 14	4A	0 3 7	1 3 7	1 0 0
	2A	0 2 21	1 1 7	0 2 14	11A	0 3 0	1 3 7	1 0 7
	12A	0 3 0	1 3 21	1 0 21	8	0 3 7	1 3 21	1 0 14
	8A	0 2 21	1 2 21	1 0 0	10	0 3 0	1 3 7	1 0 7
	9A	0 2 21	1 3 7	1 0 14	3B	0 2 14	1 2 0	0 3 14
	Average	0 3 13	1 3 14	1 0 1		0 3 13	1 3 14	1 0 1
BALLYHAISE.	10	0 2 2	1 1 17	0 3 15	8A	0 2 12	1 2 18	1 0 6
	7	0 2 16	1 1 18	0 3 2	4	0 2 14	1 2 20	1 0 6
	9A	0 2 3	1 1 23	0 3 20	7A	0 2 6	1 1 3	0 2 25
	2A	0 2 6	1 1 22	0 3 10	3A	0 1 24	1 1 5	0 3 9
	3	0 2 20	1 2 12	0 3 20	8	0 2 20	1 2 10	0 3 18
	5A	0 2 10	1 3 15	1 1 5	1	0 2 24	1 2 0	0 3 6
	2	0 3 21	1 3 9	0 3 16	4A	0 2 2	1 1 24	0 3 22
	11	0 1 24	1 0 12	0 2 16	5	0 2 6	1 1 13	0 3 7
	12	0 1 26	1 0 5	0 2 7	10A	0 2 14	1 2 5	0 3 19
	9	0 1 20	1 0 14	0 2 22	1A	0 2 4	1 1 2	0 2 26
	Average	0 2 9	1 1 20	0 3 11		0 2 10	1 1 24	0 3 14
CLONAKILTY.	22	0 3 24	1 3 11	0 3 15	19	0 3 8	1 3 25	1 0 17
	27	0 3 0	1 2 9	0 3 9	20	0 2 24	2 0 7	1 1 11
	23	0 2 20	2 0 15	1 1 23	21	0 3 10	1 3 23	1 0 13
	25	0 2 16	1 3 3	1 0 15	24	0 2 20	1 3 7	1 0 15
	26	0 2 8	1 3 11	1 1 3	28	0 2 16	2 1 3	1 2 15
	33	0 2 16	1 3 7	1 0 19	31	0 2 14	1 1 27	0 3 13
	30	0 3 0	1 3 27	1 0 27	34	0 2 22	1 2 15	0 3 21
	32	0 2 16	1 3 25	1 1 9	29	0 2 16	1 3 19	1 1 3
	Average	0 2 23	1 3 13	1 0 18		0 2 23	1 3 16	1 0 21

It will be observed that the returns from the different centres are remarkably uniform and that practically similar gains were made by both lots at each centre. No difference in the appearance of the two lots was noticeable at any centre and the pigs in each lot were sold at the same rate per hundredweight. At two centres the dead weight of the pigs in each lot was determined and the percentage of dead to live weight was as follows :—

Centre.	*Lot fed on Old Champion Potatoes.*	*Lot fed on Lochar Potatoes.*
	per cent.	per cent.
Athenry	74.9	74.2
Ballyhaise	73.9	76.3

Reporting on the quality of the bacon produced by the two lots sent from the Athenry centre the Curers stated that the general quality of the two lots was similar.

Similarly in the case of the pigs from the Ballyhaise centre no difference in the appearance of the carcases from the two lots could be detected.

SECOND SEASON'S TRIALS.

The trials were repeated on exactly the same lines at the same three centres in season of 1928. The yields from the two varieties are shown in Table IV. At two centres ware and small and diseased tubers were weighed separately. At the third centre the total weight only was determined.

TABLE IV.

Centre	Old Champion.			Lochar.		
	Ware	Small and diseased	Total	Ware	Small and diseased	Total
	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.
Athenry	8 17 0	4 0 0	12 17 0	12 17 0	2 15 2	15 12 2
Ballyhaise... ...	—	—	8 0 0	—	—	12 0 0
Clonakilty... ...	5 6 2	3 6 0	8 12 2	5 17 0	2 8 0	8 5 0
Average yield ...			9 16 2			11 19 1

Comparison of the total yields :—

Old Champion—100. Lochar—122.

As in the first season's trials, a higher average total yield was produced by Lochar than by Old Champion. At the Clonakilty centre the latter variety produced the better yield. It will be noticed, however, that the increased yield in this case was solely accounted for by the larger quantity of small and diseased tubers.

Samples of the two varieties from all centres were submitted for analysis early in November, soon after the crops were lifted and again in January when the tubers had been in store for some time. As in the previous season's tests the composition of the samples from the same variety grown at the different centres and of the samples drawn at different periods was found to be very similar. The average results obtained from the analysis of the six samples of each variety are set out in Table V.

TABLE V.

Variety.	Moisture	Oil	Protein	Carbo-hydrate	Fibre	Ash
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Old Champion ...	73·2	·03	2·05	23·04	·6	1·08
Lochar	78·45	·03	1·51	18·73	·53	·77

The chemical composition of the samples submitted in the second season is very similar to that of the samples drawn from the produce of the first year's crops. The Old Champion tubers were again found to contain less moisture than those of Lochar.

Feeding Test.

The feeding test in the second season was conducted on exactly the same lines as in the first season. The duration of the experiment at each centre was as follows:—

Athenry	...	90 days
Ballyhaise	...	85 ,,
Clonakilty	...	106 ,,

None of the animals in the experiment suffered any ill health during the period of the trial and while both lots consumed the allotted ration it was observed that, as in the previous trial, the pigs fed on the Lochar variety of potatoes cleared up their food in a shorter period than those fed on Old Champion potatoes. Particulars of the weight of the individual pigs in the two groups at each centre at the beginning and at the end of the experimental period together with the individual increases in live weight and the average for each lot are set out in Table VI.

TABLE VI.

Centre.	Lot fed on Old Champion.				Lot fed on Lochar.			
	Pig No.	Initial weight	Final weight	Live weight increase	Pig No.	Initial weight	Final weight	Live weight increase
		c. q. lb.	c. q. lb.	c. q. lb.		c. q. lb.	c. q. lb.	c. q. lb.
Athenry.	5	0 2 14	1 2 21	1 0 7	11	0 2 14	1 3 0	1 0 14
	2	0 2 12	1 2 7	0 3 23	7	0 2 12	1 3 14	1 1 2
	3	0 2 5	2 0 21	1 2 16	9	0 2 12	1 3 7	1 0 23
	4	0 2 16	1 3 0	1 0 12	12	0 2 7	1 2 14	1 0 7
	10	0 2 0	1 3 0	1 1 0	8	0 2 2	1 3 14	1 1 12
	4A	0 2 19	1 2 21	1 0 2	5A	0 2 17	1 3 14	1 0 25
	9A	0 2 7	1 3 14	1 1 7	11A	0 2 12	1 3 14	1 1 2
	12A	0 1 17	1 2 21	1 1 4	1	0 2 0	1 2 7	1 0 7
	1A	0 1 17	1 1 0	0 3 11	8A	0 1 25	1 2 7	1 0 10
	10A	0 2 4	1 3 14	1 1 10	2A	0 2 0	1 3 7	1 1 7
	Average	0 2 6	1 2 26	1 0 20		0 2 7	1 3 1	1 0 22
Ballyhaise.	2AX	0 3 0	2 0 0	1 1 0	1U	0 2 7	1 3 0	1 0 21
	504Y	0 2 14	1 3 14	1 1 0	4AX	0 2 14	2 0 0	1 1 14
	3AX	0 2 16	2 1 0	1 2 12	502Y	0 2 12	2 0 0	1 1 16
	505Y	0 2 12	2 0 14	1 2 2	501Y	0 3 9	1 2 14	0 3 5
	3U	0 2 14	1 3 0	1 0 14	10X	0 2 18	2 0 0	1 1 10
	6U	0 2 14	1 3 0	1 0 14	7U	0 2 17	1 2 0	0 3 11
	2U	0 2 8	1 3 14	1 1 6	ZAX	0 3 0	2 1 0	1 2 0
	4U	0 2 20	2 0 0	1 1 8	1AX	0 2 18	2 0 14	1 1 24
	0X	0 2 21	1 3 0	1 0 7	6U	0 2 26	2 0 0	1 1 2
	X	0 3 7	2 1 14	1 2 7	1023Y	0 2 26	2 1 0	1 2 2
	1029Y	0 2 21	2 1 14	1 2 21	8U	0 2 14	1 2 21	1 0 7
	506Y	0 2 21	1 3 14	1 0 21	1005Y	0 2 14	2 0 0	1 1 14
	Average	0 2 19	2 0 0	1 1 9		0 2 20	1 3 21	1 1 1
Clonakilty.	1	0 1 22	1 1 11	0 3 17	9	0 1 23	1 3 5	1 1 10
	2	0 1 19	1 1 18	0 3 27	10	0 1 21	1 3 7	1 1 14
	3	0 2 10	1 2 24	1 0 14	11	0 2 9	2 2 0	1 3 19
	4	0 2 9	1 3 25	1 1 16	12	0 2 4	1 2 6	1 0 2
	5	0 1 25	1 1 6	0 3 9	13	0 1 24	1 2 18	1 0 22
	6	0 2 5	1 3 13	1 1 8	14	0 2 2	1 3 3	1 1 1
	7	0 1 25	1 2 22	1 0 25	15	0 2 0	1 3 17	1 1 17
	8	0 1 16	1 1 14	0 3 26	16	0 1 20	1 0 22	0 3 2
	Average	0 1 27	1 2 10	1 0 11		0 1 27	1 3 3	1 1 4

The returns from the two lots at the different centres are not so uniform as in the first season's trials. At the Athenry centre practically similar increases in weight were made by both lots. At the Ballyhaise centre the lot fed on Old Champion did somewhat better than those fed on the Lochar variety of potatoes whilst at Clonakilty the latter group made a substantially greater increase in weight. Taking the average of all three centres there is but little difference in the returns from the two lots but with a slight advantage in favour of the group fed on the Lochar variety.

No difference in the appearance of the fattened pigs in the two lots was observed at any of the centres and all the animals were disposed of at the same price per hundredweight.

At all three centres it was found that the Old Champion potatoes did not store as well as those of the Lochar variety. The former had to be turned regularly and the badly diseased tubers removed while the latter variety kept almost free from disease throughout the period of storage.

SUMMARY AND CONCLUSIONS.

The average total yield per statute acre produced by each of the varieties in the trials conducted during two seasons at three centres was as follows :—

	tons	cwt.
Old Champion ...	10	5
Lochar ...	12	19

A smaller proportion of the tubers of the Lochar variety were in every case graded as small and diseased and during the period of storage, extending into the Spring months, the tubers of the Lochar variety kept much better than those of Old Champion. These results are in close agreement with those obtained in similar trials conducted previously and it is quite evident that Old Champion does not compare favourably with Lochar in cropping capacity or in resistance to disease.

Periodic analyses of several samples of each variety showed that the Old Champion tubers contained less moisture than those of Lochar and it is probable that the superior table qualities of the former as compared with the latter are mainly attributable to this factor.

In feeding trials conducted with 120 pigs during two seasons at three different centres where, in addition to a mixture of meals, one lot was fed on potatoes of the Old Champion variety and the other lot with an equal weight of potatoes of the Lochar variety the following increases in live weight were made by the two lots.

	cwt.	qr.	lb.
Lot fed on Old Champion	66	1	24
Lot fed on Lochar ...	67	2	13

In view of the fact that the Old Champion potatoes contained a higher percentage of dry matter than those of Lochar, it is difficult to explain why the lot fed on the latter variety gave slightly the better return. It is probable

that the slightly higher dry matter content of the Old Champion may have been balanced by some factor in favour of Lochar not revealed in the analyses. There is some evidence in favour of this supposition as at each centre it was found that the pigs fed on the Lochar potatoes consumed their food with apparently greater relish that those fed on tubers of the Old Champion variety. No difference in the appearance of the finished animals, or in the carcases of the pigs in either lot could be detected at any centre.

Seeing that in these trials the Lochar variety produced a much higher yield than Old Champion ; that the tubers kept better during storage ; and that they gave slightly better results when fed to pigs it is obvious that, where potatoes are grown mainly for stock-feeding purposes, it is more profitable to cultivate a heavy yielding variety than to rely on Old Champion. The latter variety is undoubtedly superior to most other varieties in table qualities and in these trials it was found to be richer in dry matter than Lochar. The higher dry matter content of the Old Champion is, however, not nearly sufficient to counter-balance its low yielding capacity and poor keeping qualities as compared with Lochar. Even though the Old Champion is of better table quality than most other varieties the proportion of potatoes used for human consumption on the farm is so small, in comparison with the quantity used for stock-feeding, that it will generally be found economical to restrict the area under Old Champion to very small dimensions and increase that under the more prolific varieties.

THE FEEDING VALUE OF WHEAT FOR FARM LIVE STOCK.

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Up to about the year 1800 live stock were fattened on home produced food only. We find, for instance, in the records of the London Smithfield Club that a bullock fattened on oil cake and exhibited at the Club Show in 1800 was considered a great novelty. While at the Bath and West Show of 1799, it is on record that the fattest and best quality animal exhibited was disqualified because it was fed on oil-cake. Since that period, however, owing largely to the development of the hydraulic press and the increasing demand for vegetable oils, oil cakes as bye-products have been coming on the market in increasing quantities. At first there was no great demand for these cakes and their price was accordingly comparatively low.

In more recent years the development of industrialism throughout the world and the consequent enormous increase in urban populations brought about a great demand for wheaten flour, and in the milling of the wheat large quantities of offals—bran and pollard—were made available to the farmer. In addition, North and South America and Australia were concentrating on the production of maize which was ocean borne at very low rates, with the result that cheap corn was imported in vast quantities. These factors had a very adverse effect on tillage in this country and an increasing proportion of the concentrated foods fed to our farm live stock were imported or artificially prepared. Linseed cake and cotton cake very quickly replaced beans and peas; while pollard, bran and maize were largely used as a substitute for barley and oats.

Latterly, however, the development of early maturing breeds of cattle, sheep and pigs in the principal livestock producing countries, the evolution of the high-yielding milch cow, and the breeding of poultry with high egg records, created an unprecedented demand for purchased feeding stuffs, and in consequence there has been a marked increase in the price of these commodities in this country in comparison with the price of livestock, livestock products and other farm produce, as may be seen from the following tables :—

Average Prices of the more commonly Imported Foods per cwt.

	1913	1926	1927	1928	1929	per cent. increase over 1913
	s. d.	s. d.	s. d.	s. d.	s. d.	%
Indian Meal ...	6 7½	10 8½	10 3	12 1	11 9½	78
Bran ...	5 5½	10 10	11 5½	12 2	11 8¼	114
Pollard ...	6 10½	10 9½	11 6	12 2	11 4½	65
Linseed Cake ...	9 9	15 10	15 5	15 9	15 4¼	57
Dec. Cotton Cake	9 3	14 6½	13 9	15 3	15 2¾	64
Palm Nut Cake	6 6	9 8½	12 10	11 10	12 0¼	85

AVERAGE PRICES OF BEEF, MUTTON, PORK, BUTTER, PER CWT. AND EGGS PER 120.

	1913	1926	1927	1928	1929	per cent. increase over 1913
	s. d.	s. d.	s. d.	s. d.	s. d.	%
Beef	62 5	79 9	74 6	80 0	78 2	25
Mutton ...	70 5	95 0	85 3	98 6	98 10	32
Pork ...	63 8	96 0	73 3	72 9	86 9	36
Butter ...	103 1	146 10	151 1	155 10	161 10	57
Eggs	9 5	13 1	12 6	12 5	15 1	60

AVERAGE PRICES FOR GRAIN PER CWT. DURING THE LAST QUARTER OF EACH YEAR.

	1913	1926	1927	1928	1929	per cent. increase over 1913
	s. d.	s. d.	s. d.	s. d.	s. d.	%
Wheat ...	7 4½	12 0	10 1	9 6	10 0	36
Oats	5 11½	7 4	7 4	7 6	6 1	2
Barley ...	7 4¾	7 11	9 5	7 11	8 0	9

The above figures show that while the prices of purchased food-stuffs have increased enormously since 1913, there has not been a corresponding increase in the value of Irish farm produce. As regards the latter, however, they show that livestock and livestock products have on the whole increased in value more than have tillage products.

Having regard, therefore, to the striking contrast in price between the various imported foods and Irish farm produce, the farmer must decide in what direction economy in production lies—whether, for instance, it is more profitable for him to sell his home-grown grain and buy imported, or artificially prepared food-stuffs, or to convert his cereals into beef, mutton, bacon, milk or eggs.

The relative feeding values of the imported and artificially prepared foods as compared with home grown grain must be taken into consideration. In this connection attention is drawn to the experiments that have been carried out by the Department of Agriculture to determine the feeding value of home-grown cereals in comparison with some of the more commonly imported food-stuffs. The results of these trials indicate that barley (1) and oats (2), at present prices, may be used with advantage to replace some, at least, of the imported or artificially prepared foods in the feeding of calves, and the fattening of cattle and pigs. In the case of wheat, however, very little is known of its comparative feeding value for live stock and farmers are, therefore, reluctant to grow it for that purpose. The area of wheat grown in this country is, at

present, relatively small, the grain produced being for the most part used for home bread baking on the farms where grown or sold for human consumption and at prices that are not always remunerative.

Wheat is a crop generally associated with heavy land and is grown on clay soils in preference to the other cereal crops because it is less liable to lodge. Many heavy clay soil farms in this country are now devoted entirely to grazing because of the difficulties and expense in harvesting a lodged crop of oats ; wheat growing is either not understood or is considered unremunerative when grown as a cash crop. Such farms were under consideration when it was decided to carry out the following investigations on the feeding value of wheat.

WHEAT *versus* WHEAT OFFALS.

Pig Feeding Experiment.

From the foregoing table of prices it will be seen that in recent years wheat was sold at a lower price than the farmer would have to pay for bran and pollard. The first experiment was therefore designed to compare the feeding value of wheat with a mixture of bran and pollard for the fattening of pigs and was conducted as follows :—

Fifty pigs from eight to seventeen weeks old were selected and divided into five groups according to age. Each group was then further divided into even lots, with due regard to sex, age, quality and live-weight of the animals. The pigs selected were of the Irish Large White breed, they were all got by the same boar and from sows closely related and were thus very suitable for experimental work. They were given the following mixture of foods *ad lib.*, and the quantity consumed by each lot recorded.

Wheat Lot.	*Wheat Offal Lot.*
6 parts ground wheat.	4 parts pollard.
2 parts maize meal.	2 parts bran.
1 part palm nut meal.	2 parts maize meal
1 part fish meal.	1 part palm nut meal
	1 part fish meal.

Thus one ration contained 60 per cent. wheat and the other 60 per cent. wheat offals. The pigs in each group were placed on their respective rations for a preliminary period of two weeks before the experiment proper was started in order to become accustomed to them.

The animals were weighed at the beginning and again at the end of the experimental period on two consecutive days and at approximately the same hour each day, the mean of each of the two weighings being taken as the initial and final weights respectively.

The pigs were also weighted at fortnightly intervals throughout the experiment for the purpose of recording fully the comparative results and to determine how the animals were thriving. Observations were made through-

out the experimental period on the general appearance and condition of the pigs. In this connection it was noted that the wheat lots had a cleaner skin and a more thrifty appearance than those on the pollard and bran ration.

As the experiment was conducted indoors all the pigs were allowed a small quantity of green food—either cabbage or grass—each day. During the last six weeks of the experimental period the feeding of fish meal was discontinued in order to avoid the possibility of the quality of the carcase being adversely affected.

A summary of the results is shown in the following table :—

Group.	No. of Animals in each Group.	Age at Start.	Period of Experiment.	Average Initial Live-weight		Average Final Live-weight		Average Daily Live-weight Increase.	Food taken to produce 1 lb. Live-weight Increase.
		Weeks.	Days.	st.	lbs.	st.	lbs.	lbs.	lbs.
Group I.									
Wheat ...	5	8	97	2	8·7	13	1	1·50	3·36
Pollard and Bran	5	8	97	2	6·7	10	11	1·20	3·45
Group II.									
Wheat ...	5	10	118	2	10·3	16	4	1·61	3·66
Pollard and Bran	5	10	118	2	10·5	13	0	1·21	4·14
Group III.									
Wheat ...	6	10	84	2	13	12	3	1·55	3·90
Pollard and Bran	6	10	84	3	2	10	8·5	1·24	4·40
Group IV.									
Wheat ...	5	17	96	3	9·6	15	11	1·76	4·50
Pollard and Bran	5	17	96	3	7·2	15	11	1·35	4·87
Group V.									
Wheat ...	4	17	83	5	9·8	17	10	2·02	3·7
Pollard and Bran	4	17	83	5	9·8	14	5	1·47	4·3

The results obtained from the five tests conducted show that the pigs fed on wheat made a greater daily live-weight increase than those fed on pollard and bran; furthermore, they show that the quantity of food required to put on 1 lb. live-weight increase was lower in the case of the wheat fed animals than in the case of those fed on pollard and bran. Expressing the difference in the average daily live-weight increase between the lots as a percentage, it will be seen that the difference in favour of the wheat fed lots varied from 25 per cent. to 37 per cent., indicating quite clearly a superiority of wheat over wheat offals for pig feeding.

Carcase Weight and Quality.—Three pigs from each lot in Group II., two from each lot in Group IV., and all the animals in Group V. were sent to a bacon

factory at the end of their respective experimental periods, and the dead weight figures obtained. The animals were weighed alive before being sent to the factory and the following table shows the percentage of dead-weight to live-weight.

GROUP II.

Wheat Lots.		Pollard and Bran Lots.	
Number of Animal.	Percentage dead-weight to live-weight.	Number of Animal.	Percentage dead-weight to live-weight.
13	79·5	26	77·2
22	77·0	27	75·5
D 19	78·1	O 56	73·8
Average	78·2		75·5

GROUP IV.

B 9	79·5	B 11	75·2
B 10	79·7	644	80·5
	79·6		77·8

GROUP V.

B 12	82·8	B 14	75·9
B 13	78·0	640	75·0
648	81·1	645	77·2
641	80·7	D 24	70·9
	80·6		74·75

The foregoing table shows that the wheat fed animals had a higher percentage dead-weight than the animals fed on pollard and bran.

An expert's report on the quality of the carcases was also obtained and in every case the carcases of the wheat fed pigs were regarded as superior to those of the pollard and bran fed pigs.

WHEAT *versus* OATS.

Calf Rearing Experiment.

The value of oats for calf rearing is so well known that it is not necessary to comment further on it here. Little is known, however, of the feeding value of wheat either for calves or fattening cattle. In order, therefore, to obtain some information as to the comparative value of wheat and oats for feeding calves the following trials were carried out :—

Sixteen commercial shorthorn calves, the progeny of the College dairy herd, were selected for the test. They were divided into two groups as follows :—

Group I. Calves 4 to 9 months old.
Group II. Calves 9 to 11 months old.

Each group was then sub-divided into two lots as evenly as possible, taking into consideration the age, sex, quality and live-weight of the animals.

The calves in Group I. were fed on an average daily ration as follows :—

Roots	...	43·75 lb.
Meal Mixture	...	3·80 lb.
Hay	...	*ad lib.*

The meal mixture used for each lot was made up as follows :—

Wheat lot.	*Oats lot.*
2 parts ground wheat.	2 parts crushed oats.
1 part linseed cake.	1 part linseed cake.

The animals were fed three times daily and were given one-third of their daily ration at each meal. A smaller ration than the above was given at the commencement of the test, but as the experiment progressed and the animals grew older, the quantity of roots and meals was increased to a maximum of 49 lb. roots and 4 lb. of meal mixture per head per day. The quantity of hay consumed was recorded and was found to be approximately the same for each lot.

The experiment extended over a period of 93 days, the animals being weighed on two consecutive days at the start and at the finish of the trial ; the mean of each of these two weighings was taken as the initial and final live-weights, respectively. Weighings were also made at fortnightly intervals to ascertain how the animals were progressing.

A summary of the results obtained is shown in the following table :—

Lot.	Average Initial Live-weight.	Average Final Live-weight.	Average Live-weight Increase.	Period of Experiment.	Average Daily Live-weight Increase.
	C. Q. LB.	C. Q. LB.	C. Q. LB.	Days	LB.
Wheat ...	2 3 17	4 1 2	1 1 13	93	1·63
Oats ...	2 3 17	4 2 0	1 2 11	93	1·92

These figures show an average daily difference of 0·29 lbs. in favour of the oats fed lot.

The calves in Group II. were fed on an average daily ration as follows :—

Roots ...	...	23 lb.
Silage (oat and tare)		21 lb.
Meal Mixture	...	4·7 lb.
Hay ...	...	*ad lib.*

The meal mixture given to each lot in this Group was similar to that used in the experiment with the younger calves and the management and weighings were carried out on the same lines. The experiment extended over a period of 67 days and the following table shows a summary of the results :—

Lot.	Average Initial Live-weight.	Average Final Live-weight.	Average Live-weight Increase.	Period of Experiment.	Average Daily Live-weight Increase.
	C. Q. LB.	C. Q. LB.	C. Q. LB.	Days	LB.
Wheat ...	4 3 24	5 3 26	1 0 2	67	1·70
Oats ...	4 3 24	5 3 12	0 3 16	67	1·49

The foregoing figures show that the calves on the wheat ration made a greater daily live-weight increase than those on the oat ration, the difference in favour of the former ration being 0·21 lb. live-weight per day.

WHEAT *versus* OATS.

Stall-feeding Experiment.

Twenty two-year-old commercial shorthorn bullocks were selected for this trial and were divided into two even lots, taking into consideration the age, quality and live-weight as well as the average daily live-weight increase of each animal during a period of six weeks previous to the experiment. They were then fed on the following rations :—

Roots	28 lb.
Silage (oat and tare)	35 lb.
Meal Mixture ...	9 lb.
Hay and water ...	*ad lib.*

The meal mixture given to each lot was composed of :—

Wheat lot.	*Oat lot.*
2 parts Rolled Wheat.	2 parts Rolled Oats.
1 part Linseed Cake.	1 part Linseed Cake.

At the commencement of the experiment, the cattle received 6 lb. of meal mixture per head, per day, and as the experiment progressed this quantity was increased to a maximum of 12 lb. per head, per day. The quantity of meal mixtures shown in the above rations is, therefore, the average over the whole period of the test. The method of feeding was as follows :—

Morning, ½ Silage and ⅓ Meal Mixture.
Noon, all roots and ⅓ Meal Mixture.
Evening, ½ Silage and ⅓ Meal Mixture.

The quantity of hay consumed by both lots was recorded. The trial proper

extended over seventy-two days, the animals being weighed at intervals to ascertain how they were progressing.

The animals were weighed at the beginning and again at the end of the trial on two consecutive days and at the same hour each day and the mean of each of these weighings was taken as the initial and final weights, respectively.

A summary of the results obtained is shown in the following table :—

Lot.	Average Initial Live-weight.	Average Final Live-weight.	Average Live-weight Increase.	Period of Experiment.	Average Daily Live-weight. Increase.
	C. Q. LB.	C. Q. LB.	C. Q. LB.	Days	LB.
Wheat ...	9 2 1	10 3 9	1 1 8	72	2·05
Oats ...	9 2 1	10 2 27	1 0 26	72	1·92

These figures show a difference in the average daily live-weight increase of 0·13 lb., or of 6·7 per cent. in favour of the wheat fed lot.

WHEAT *versus* OATS PLUS BRAN.

Dairy Cows.

In order to obtain some further information as to the feeding value of wheat, it was decided to determine how it compared with a mixture of oats and bran for milk production.

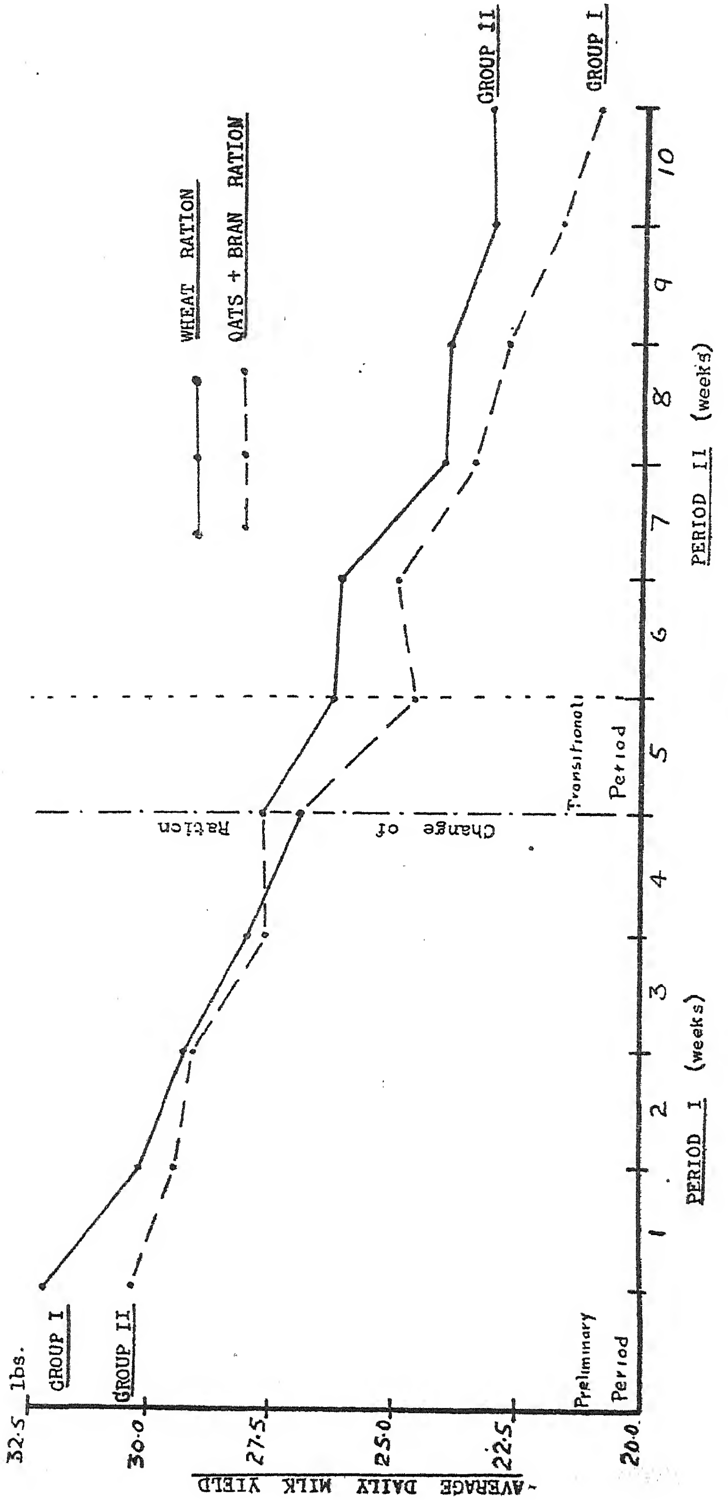
For the purpose of this experiment, eight commercial shorthorn cows were selected from the College herd and divided, so far as possible into two comparable groups, having regard to the quality, live-weight, date of calving and milk yield of each animal. The cows were then fed on the following rations daily :—

70 lb.	...	Roots
3·5 lb.	...	Meal Mixture per gallon of milk.
		Hay *ad lib.*

The meal mixture for each group was composed of :—

Wheat fed Group.	*Oat and Bran fed Group.*
6 parts rolled wheat.	4 parts rolled oats.
	2 parts bran.
4 parts decorticated cotton cake.	4 parts decorticated cotton cake.

The experiment extended over a period of eleven weeks. The first week, during which the animals were becoming accustomed to their rations, was treated as a preliminary period. When the cows had been four weeks on the



SHOWING THE AVERAGE DAILY MILK YIELD FOR EACH GROUP

D

experiment proper, the concentrated foods were interchanged, that is the cows on wheat were changed on to oats and bran, and the oat and bran group were changed over to wheat. The experiment was then continued for a further period of six weeks. The first week of this period was treated as transitional, during which the animals were becoming accustomed to their new food. Moreover, since the fact of changing food alone might affect the milk yields, the figures recorded during that week were not included in the expe iment proper.

A summary of the results obtained is shown in the following table :—

AVERAGE DAILY MILK YIELD.

Preliminary Period.	Period I. Wheat Ration.				Change over Period.	Period II. Oat + Bran Ration.				
7 days	1st wk.	2nd wk.	3rd wk.	4th wk.	5th wk.	6th wk.	7th wk.	8th wk.	9th wk.	10th wk.
lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
32·3	30·4	29·2	28·0	26·8		24·9	23·4	22·7	21·6	20·9

Preliminary Period.	Period I. Oat + Bran Ration.				Change over Period.	Period II. Wheat Ration.				
7 days	1st wk.	2nd wk.	3rd wk.	4th wk.	5th wk.	6th wk.	7th wk.	8th wk.	9th wk.	10th wk.
lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
30·4	29·4	29·1	27·6	27·7		26·1	24·0	23·9	23·0	23·1

From the foregoing figures it will be seen that during the first period of the experiment proper, there was practically no difference between the milk yields of the two groups. When the rations were changed over, however, there was a reduction of milk yields in both groups, but the decrease was somewhat greater in the case of the oat and bran fed group.

The difference in yield is more evident when the results as represented in the graphs on the previous page are examined and the indication is that wheat is slightly superior to oats and bran for milk production.

SUMMARY OF RESULTS.

1. A ration for pigs containing 60 per cent. of wheat gave on an average over 30 per cent. better results than one containing 60 per cent. of a mixture of bran and pollard.

2. In the ration for calves four to nine months old, oats gave slightly better results than wheat.

3. In the ration for calves nine to eleven months old, wheat gave slightly better results than oats.

4. In the ration for fattening cattle wheat gave slightly better results than oats.

5. In the ration for dairy cows, six parts by weight of wheat gave slightly better results than a mixture of four parts by weight of oats plus two parts by weight of bran for milk production.

CONCLUSIONS.

The results of these experiments show that wheat is a suitable food for pigs, calves, fattening cattle and dairy cows.

When allowance is made for the experimental error contingent to the foregoing experiments it may be assumed that :—

(*a*) for calves and fattening cattle, wheat and oats are of about equal value ;

(*b*) for milk production, six parts of wheat are equal in feeding value to four parts of oats plus two parts of bran ;

(*c*) in the rearing and fattening of pigs, six parts of wheat have a much higher feeding value than four parts of pollard plus two parts of bran. The average price of the latter mixture in 1929 was £11 13s. 4d. per ton, whereas Irish farmers sold their wheat at about an average of £10 per ton.

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WICKLOW MOUNTAIN SHEEP.

THEIR HISTORY AND IMPROVEMENT.

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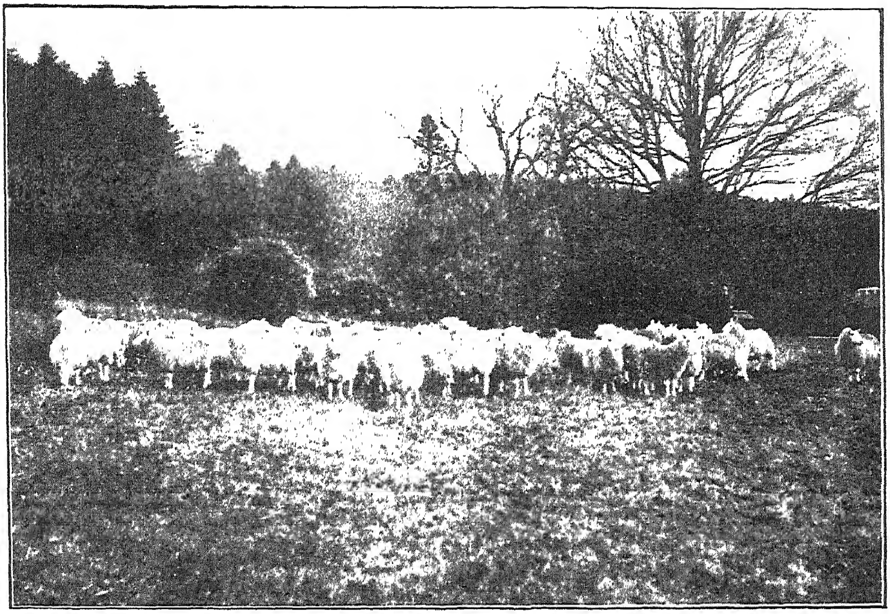
Wicklow county covers an area of approximately half a million acres, a little more than a quarter of which may be described as mountain sheep pastures. These pastures rest for the most part on granite, except in the north-eastern region, where the rock is of quartzite; mica formations are found in several parts of the county but comprise only a small proportion of the substratum. The mountain range, the slopes of which form the pastures, extends from the lowlands in the north-east, where the Sugar Loaf rises, to where the south-western slopes of Keadeen and Lugnaquilla merge into the plains of Carlow. The rugged grandeur of the lofty peaks and the mystic beauty of the glens and streams of this range are renowned far and wide. This mountain group constitutes not only the background of Wicklow's scenic beauty, but its gorse and heath-clad slopes are the foundation of pastoral farming in the county. Industrial conditions in the country may alter and market requirements may change but the Wicklow hills will almost certainly continue as they have been for centuries, a reserve for breeding mountain sheep.

Mountain pasture and sheep farming are so closely associated that the mention of one suggests the other, and since sheep farming is the only remunerative use to which such large tracts of the land of Co. Wicklow can be devoted, it is imperative that this industry be encouraged and developed to the best possible advantage. From the earliest times the Wicklow mountains have been renowned for their sheep, and for the past sixty years the number of sheep in the county has been maintained in the neighbourhood of 200,000. At present the majority of the sheep kept is of a distinct type which has been indigenous to the mountains for centuries. Mountain environment, severe weather conditions and scarcity of keep in winter season, combined with skilful breeding, have resulted in the Wicklow mountain sheep possessing in a marked degree a number of very valuable characteristics, such as extreme hardiness, freedom from foot rot and from many other diseases to which sheep are generally subject; besides which the ewes as well as being prolific are particularly good nurses.

The date of the origin of the Wicklow Mountain sheep can only be guessed at from a consideration of relevant circumstances, principally those concerned with the woollen industry and the general history of the county.

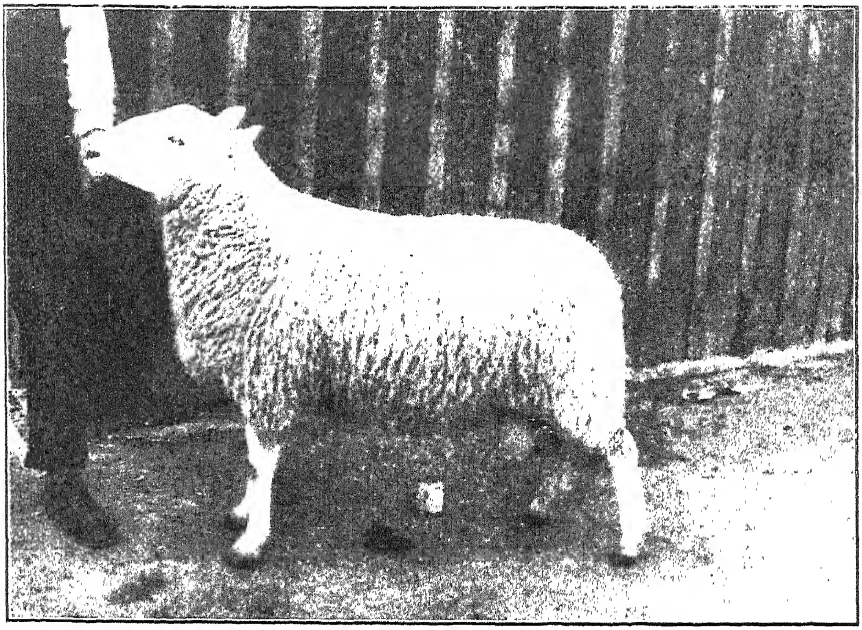
It is agreed by historians that sheep existed in Ireland from the earliest times of which there are reliable records, and sheepskin was used for many of the famous early Irish manuscripts of which we are so justly proud.

The manufacture of woollens in Ireland would appear to have commenced about the sixth century, but it was many years before the industry assumed exporting dimensions. In the old Brehon laws are many orders relating to the woollen industry, and in 1338 a declaration was issued inviting cloth

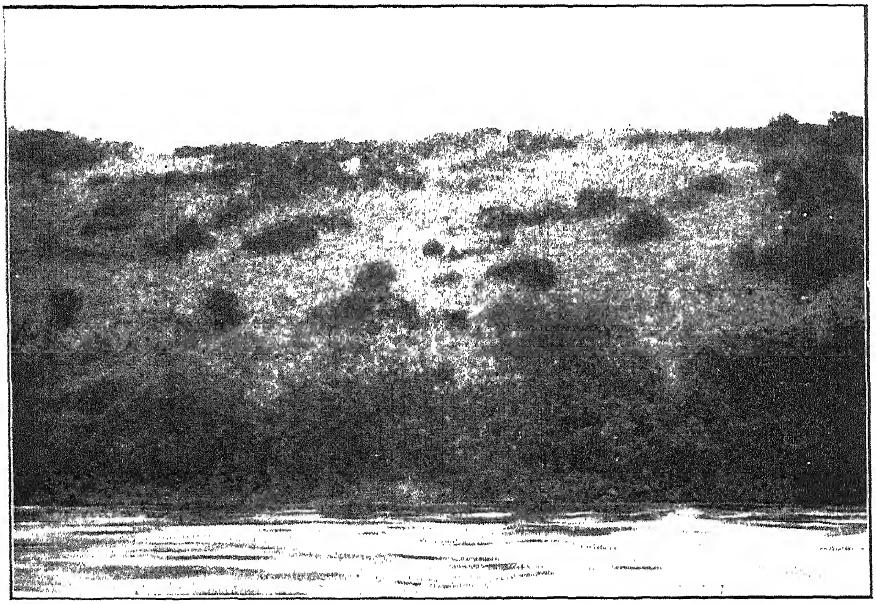


Fat Wicklow Mountain wethers at Annamoe Farm, Glendalough.

Wicklow Mountain shearling rams being inspected for registration.



A typical shearling Wicklow Mountain ram.



Wicklow Mountain sheep on their native pasture.

workers from foreign countries to visit Ireland and inspect the quality of the wools and yarns. In the Statute of Kilkenny, 1367, English settlers in Ireland were forbidden to wear Irish-made clothes. This measure, however, was intended to prohibit any intercourse between the native Irish and the Englist settlers who were inclined to become "more Irish than the Irish" rather than to discourage the woollen trade. Although direct prohibitive tariffs measures were in operation from the year 1569 the woollen trade flourished and reached its zenith about 1687. The exports of sheep, wools and woollens for the year ending March 20th, 1641, for which year fairly complete records from the principal seaport towns are available, were:—

Sheep	34,841	
Sheep and lamb skins ...	4,778	cwts.
Wool	151,576	stones of 16 lbs.
Frieze	279,722	yards.
,, stockings ...	4,287	doz.
Rugs	4,778	
Blankets	6,589	

In addition to the quantities recorded as having passed through the ports a considerable volume of wool, skins, etc., was smuggled out of the country in order to escape the heavy export duties.

About the middle of the 15th century the industry had assumed such dimensions, the manufacturers had become so expert, and the amount of labour for small wages was so large, that, despite the export duties and shipping costs, Irish woollen merchants were able to undersell English merchants not only in the spun-wool markets of Holland and the manufactured-woollens markets of Flanders, but also in the market for both these commodities in England itself. The measures taken by the English Government of the day to overcome this condition of affairs in the statutes passed for the suppression of the Irish woollen trade belong to modern history; the indications, however, are that at this time the Wicklow mountain sheep were contributing very materially to the reputation of Irish woollens. Thus at the time when Bakewell was making his early attempts to improve long-horn cattle, and when sheep breeds in general afforded to skilful breeders the opportunity to make fame and fortune from their improvement, there existed in the Wicklow mountains a valuable breed of fine-woolled sheep which was distinct in appearance and character from any breed then in existence in these islands.

The flourishing condition in which the Wicklow Mountain sheep existed in the eighteenth century is indicated by the fact that in 1793 the Flannel Hall in Rathdrum was built by Earl Fitzwilliam, at a cost of £3,500, to serve as a mart for the sale of the produce of the Wicklow mountain wool. A toll of 2d. was charged on every 120 yards of flannel sold, and the receipts from this toll amounted annually to £300. An auctioneer together with an assistant and eight certified measurers were officially appointed to carry on the sales.

During the latter half of the eighteenth century there was a tendency to transfer the making of flannels from the home hand looms to factories, and

a number of these were built throughout the county, one of the largest being at Greenane, on the Avonbeg, and which was burned down during the 1798 rebellion.

The wool of the Wicklow Mountain sheep was of very fine quality and was manufactured—in early times in hand looms and later in the mills—into flannel of special quality. Little of the wool as such found its way on to the markets; consequently few records are available to indicate the prices which the wool might have realised at different periods. The following particulars, however, are of interest as showing the price paid for such of the wool as was offered for sale early in the nineteenth century. The particulars are taken from the book on Wicklow Farming by the Rev. Thomas Radcliff, and relate to the *Annual Auction Sale of Clothing Wool* shorn in Ireland, at the Farming Society's House in Summer Hill, Dublin, auctioned by Ebenezer Dix on July 23, 24 and 25, 1811:—

Owner		Number of fleeces	Quality.	Weight lbs. oz.	Price per lb.
Rev. Thos Quinn	...	57	best	2 0	2s. 3d.
Do.	...	20	second	2 6¼	1s. 3d.
Col. Keating	...	116	—	2 7½	1s. 11d.
Wm. Parnell Hayes	...	110	—	2 0¾	1s. 8d.
Rev. Dr. Truell	...	35	—	2 10	2s. 1d.

The Wicklow Farming Society appears to have consisted mainly of the proprietors of large estates of the best land in the county and, in what can only be termed a spirit of misapplied philanthropy, offered large premiums to encourage the crossing of the Wicklow Mountain sheep with South Down rams in order to improve the former breed for mountain grazing. These premiums applied not only to the sheep resulting from the cross but to the wool and the cloth manufactured from the wool of the South Down and the cross-bred, with the result that in many cases fabulous prices, even as high as 10s. per lb., were paid for such wool.

The suitability of the cross for the purpose referred to needs no comment at the present day, and the light in which it was regarded then by the mountain breeders, who had no money to squander and who in most cases had high rents to pay, is best indicated by the following extract from an article, "Neat Cattle, Sheep and Swine," contributed in 1806 to Vol. V. of the Transactions of the Dublin Society:—"In the Wicklow mountains, where flannel is manufactured, there is a fine short-woolled breed of sheep carefully preserved from a cross of the English which are called 'bulls' and 'bull heads,' but the local name of the short-woolled sheep is the '*cottagh-sheep*.' A family of the name of Brady, in Glen Makanas, keeps a large flock of the breed of pure blood. As the people are flannel manufacturers they are strictly careful to avoid mixtures of the 'bull' breed, the 'cottagh' bearing much finer wool. This sheep has a small head; narrow face; short, round pricked ears; the head and face being smooth and covered with hair as the wool extends only to the joining of the head and neck; the neck is long and the general proportion good, altogether more slender than in the 'bull' or English breed; light not over clean shanks and the hair

of the tail remarkably coarse even more so than in coarse or long woolled sheep; the fleece on some matted and wavy but the finest is only wavy not matted and about two inches in length and of a silky gloss. The matted fleeces are differently sorted and combed; two pounds of wool frequently to a fleece, four pounds a great fleece. The growers don't give their wool to other manufacturers as they find much better buyers for it when wove into flannel for sale at Rathdrum in their own neighbourhood. The finest of these sell at very high prices in Dublin. This is an example of an Irish breed so very valuable and easily procurable (for it was lately to be found as near Dublin as Clohogue), absolutely invites the highly instructed farmers about this great city to search for and select a pure flock which may be done at very moderate expense."

Apart from the wool, which has become longer as a result of Cheviot crosses, might not this good historian have been describing the sheep which to-day, 124 years later, are being registered in the Flock Book?

That the Farming Society at this date were indulging in fancy rather than in an attempt to maintain or improve the quality of the mountain sheep, or at least that they were experimenting on a very lavish scale, is suggested by the fact that its members could boast flocks of the following breeds: Leicester, South Down, Ryeland, Merino, Exmoor and all the possible crosses which could be made between these breeds and between them and the mountain sheep. At the sale already referred to there were over 440 fleeces of pure Merino wool, a fair proportion of which came from the Co. Wicklow, as well as a large quantity of Merino cross wool, although the total number of fleeces sold was only 5,249. These circumstances are mentioned to indicate the condition of affairs and to reflect due credit on the sagacity of the mountain breeders who, in spite of temptation by way of single prizes of as much as £50, preserved the Wicklow Mountain sheep pure through a period when fancy rather than utility seems to have been the actuating principle in relation to sheep breeding on the part of those whose livelihood was not dependent on their flocks.

The following comments by the Rev. Thos. Radcliff as to the quality of the breed in 1812, in the publication already referred to, are also of interest:—" Their form (Wicklow Mountain sheep) is not attractive, neither is it to be held in contempt; the long and rising neck, the narrow frame and sloping rib displease the eye accustomed to the symmetry of the Leicester, but in straightness of the back and fineness of the bone they are by no means deficient. As mutton (when fat after three years old) nothing can be more delicious, weighing from 14 to 18 lbs. a quarter, sometimes more; and in point of wool bearing as they do a fleece of clothing quality, they must altogether be considered worthy of attention."

The same writer estimates the number of breeding ewes of this breed on the mountains as 20,000, which shows that it was by far more important than all the other breeds in the county put together. Continuing, he says: " The overplus of those mountain ewes is sold off at four or five years old from 13s. to 16s. each. Wethers in a store state are bought at three years old from 15s. to 20s. about May, and if well kept will sell the following spring at from 30s. to 42s. each. The mutton of this mountain breed is so

good as to be sought for from considerable distance, and some lots a little forward have been sold to fatten off for a price so high as 25s. to 30s. apiece "—by no means uncomplimentary comments from one " whose eye was accustomed to the symmetry of the Leicester."

Although some of the remarks of Youatt, writing in 1837, appear doubtful, he is convinced that the Wicklow Mountain sheep " have established themselves since time immemorial." He confirms the description of the breed already given by repeating it verbatim, and supplies some interesting information on the result of the crosses between the Wicklow Mountain sheep and the breeds already referred to. This evidence, it should be remarked, was compiled almost forty years after the first introductions of South Down rams. The Merino Wicklow Mountain cross was an unqualified failure, the South Down Wicklow Mountain cross had some merits, but the mountain breeders would not have it at any cost; thus commonsense triumphed and the quality of the breed was preserved until a date within the memory of some of the present breeders.

The second quarter of the nineteenth century, or from 1823 to 1848, approximately, which was perhaps the most disastrous period in the industrial history of Ireland witnessed amongst other things the decline and final extinction of the Wicklow flannel industry. As a result of the report of the Revenue Commissioners (Parliamentary Papers, Vol. IV., 1822), the ten per cent. *ad valorem* inport duty on certain woollens was abolished in 1823, though it had been foretold that the low state of the industry in Ireland could not withstand it. The result of the abolition was not felt until 1826, when, for certain reasons, the export trade of England was not so good as usual and a large quantity of surplus woollens was dumped on the Irish market causing a glut and the entire dislocation of the whole industry, which had only to a small extent been transferred to factories from hand looms and was not, therefore, in a position to withstand even a temporary reverse.

Otway's Parliamentary Report indicates that prior to 1816, twelve markets were held each year in Rathdrum Flannel Hall, and as many as 1,200 pieces of flannel were offered for sale at a single market. In 1822, the industry in Wicklow was giving employment to three thousand people and had attained an annual output of 7,800 pieces. By 1830, the industry had declined to such an extent that the Rathdrum Flannel Hall closed and the fairs came to an end.

The main source of livelihood of the mountain breeders had come to an end also. They found themselves in possession of a breed of sheep which, though admirably suited for its original purpose, was not adapted to the alternative—the production of mutton at an early age. While it may have been realised that the alteration of type necessary to adapt the breed to the new condition of affairs was possible only by the introduction of fresh blood, it is only reasonable to suppose that few of the breeders were in a position to make the necessary change, and some years appear to have elapsed before the first introduction of new blood was made.

The Cheviot was selected as being the best adapted for crossing with the native breed for the production of a more suitable type, and so a little less than fifty years after the Act of Union the first Cheviots were introduced

with the express purpose of crossing them with the mountain sheep. It is a coincidence perhaps worthy of mention that it was just under fifty years after the last of the Border Feuds and the Act of Union between England and Scotland that the first recorded introduction of new blood into the Cheviot breed was made.

The first Cheviot rams were brought over from Scotland by Kemmis of Ballinacor and Barton of Glendalough. As might be expected, the first cross brought a radical change in the breed, which had been kept so pure for centuries, and the breeders mentioned established good flocks which are still maintained by the family descendants. The effect of these introductions do not appear for some reason to have spread beyond their immediate neighbourhood. A pure bred flock of Cheviots, however, was established early in the fifties on Luggalaw Mountain by James Brydon, from which rams were purchased by many breeders throughout the county. The tenancy of Luggalaw passed from Brydon to Lord Powerscourt, and, about 1863, to David Steel, who also maintained a pure Cheviot flock. Various other breeders at this time also imported rams for their own use and for sale to neighbouring farmers. The general method of crossing adopted by some of the best breeders was to use Cheviot and pure bred Wicklow Mountain rams on the ewes in alternate seasons till the required characteristics had been procured.

Many of the smaller mountain breeders, as might be expected, still continued to use their own rams without introducing any fresh blood up till about the beginnining of the present century. Haphazard methods of breeding and the want of a proper ideal on the part of many owners resulted in the breed becoming somewhat mixed and lacking in character and uniformity. This condition of affairs continued for many years and, though the fine quality of the wool inherited from earlier days continued to attract the attention of some of the Bradford spinners, and the superiority of the mutton was well known to the Dublin butchers, it was realised by the majority of the breeders that they were not reaping the same benefit as would accrue if the breed bore the hallmarks of a pure breed, namely, individuality, uniformity and definite character.

During the last quarter of the century many experiments had been made to determine the suitability of other breeds and crosses for these mountain pastures. For many years Lord Powerscourt kept from 1,200 to 1,400 Black-faced Mountain sheep; various other breeders, including those already mentioned, bred pure Cheviots, but none were able to withstand the climate and conditions like those bred from foundation native stock. Black-faced Mountain sheep were found so unsuitable and unprofitable by most breeders that they were given up entirely. The obvious procedure, therefore, was to get the breeders together and to make a concerted effort for the advancement of the interests of the native breed and of the breeders collectively. This course was adopted and resulted in the establishment, in 1926, of the Wicklow Mountain Sheep Breeders' Society with the objects, as stated in the first volume of the Flock Book, as follows:—

(*a*) The encouragement of the breeding of Wicklow Sheep and development and maintenance of these sheep as a pure breed.

(*b*) The establishment and publication of a Flock Book of Rams and Ewes which have been passed as eligible for entry.
(*c*) To arrange for classes and awards of Prizes or Certificates of Merit at selected Shows.
(*d*) To make arrangements for Special Sales of Sheep, entered in the Flock Book.
(*e*) To promote the spread of information with reference to the Breeding of Wicklow Sheep by Lectures, Discussions, Correspondence, etc.
(*f*) To co-operate for any of these objects with the Department of Agriculture, the Wicklow Committee of Agriculture, and the County Wicklow Farmers' Association, and other bodies interested in the Breeding of Sheep.

An annual inspection of breeding ewes and rams is held at various centres throughout the county where the sheep are inspected by judges appointed by a Committee of the Society, and those which reach the required standard of excellence are entered in the Flock Book.

The fact that only such sheep as are passed by competent judges who are also keen breeders are registered is bound to result in a very short time in the required uniformity of type and develop that most essential attribute, breed character.

The characteristics of the breed, as published in the Society's Flock Book, are as follows:—

Colour.—White.

Head.—Medium in length, well covered with short fine white hair. Ears not too long, of fair width and rising erect from the head. Nose arched and broad, nostrils black, full and wide open.

Neck.—Moderate in length, strong and well laid into shoulders.

Shoulders.—Level on top and fitting into the ribs without any weakness immediately behind the shoulders.

Chest.—Full, deep, broad and extending well forward.

Ribs.—Well sprung.

Back.—Of medium length, level, with good strong loin. Rump wide and fleshed. Hind quarter deep and full and well let down towards the hocks.

Tail.—Broad, full, of good length, nicely fringed with wool.

Legs.—Medium length, well set, broad and flat and covered with short, hard, white hair.

Feet.—Sound, strong, well developed.

Belly.—Well covered, with short, close, fine wool.

Fleece.—Fairly fine, densely and closely grown of equal quality, well grown on the throat, near the forearms and rocks.

Skin.—Pink in colour.

Carriage.—Gay, lively, sprightly and active.

As a supplement to these characteristics it should always be borne in mind that the breed is above all a mountain breed and that such mistakes

as were made by a number of breeders towards the end of the last century in introducing size at the expense of hardiness should be guarded against. If the breeding ewes and other sheep from one year upwards cannot maintain themselves on the mountains throughout the winter one of the most valuable characters is being lost.

During the four years in which the society has been in existence it has achieved a very appreciable measure of success, and breeders in other parts of the country have come to realise not only the quality of the ewes for rearing early lambs but the suitability of the rams for crossing with other breeds in order to introduce the many desirable qualities of the Wicklow Mountain breed.

The Wicklow Mountain sheep inherit desirable characters peculiar to the breed which every effort must be made to preserve. The conformation of some flocks is not of a high standard, and an occasional introduction of new blood, together with intelligent mating and selection, will permit of the necessary grading up being made more readily than would otherwise be the case. Breeders should get the ideal type firmly fixed in their minds, and realising where their own flocks fall short of this ideal should set about remedying the defect. Above all, breed character and uniformity must be established. This can only be accomplished by the exercise of keen breeding ability and by the careful supervision and selection of suitable breeding stock, in the first instance by the breeders themselves and secondly by a body of local judges whose keen judgment qualifies them to recommend the stock which it is wise to register in the Flock Book and to reject that which, in the interests of the breed, had better be discarded. It should always be realised that in the interests of uniformity and character, stock which is of relatively good quality but showing a tendency to diverge from the ideal type must be rejected. Individual breeders may, therefore, occasionally consider that stock on which they have expended care and attention has been harshly treated in being turned down; they should, however, at all times bear in mind the wider interests of the breed as a whole and seek to remedy the faults of their flocks so as to bring them into close conformity with the recognised breed type.

The members of the society, individually and collectively, have before them a task the successful accomplishment of which should be sufficient stimulus to ensure whole-hearted interest in the work and whole-hearted support for the society. The improving quality of the breed from year to year must be the criterion by which achievement will be judged. Breeders have a tradition to preserve, and no effort should be spared in an endeavour to establish and maintain for the Wicklow Mountain Sheep a reputation for excellence and quality at least equal to that possessed by the breed in the troubled years of the eighteenth and early ninteenth centuries.

EXPERIMENTS ON THE CONTROL OF AMERICAN GOOSEBERRY MILDEW.

(1925-1929).

By Paul A. Murphy, Sc.D.

The American gooseberry mildew (*Sphaerotheca mors-uvae*) originated, as the name implies, in North America, and is a comparatively recent introduction to Europe. It was first detected in South-Western Russia in 1890, and was next found in Ireland in 1900. From that period it has gradually spread throughout the Continent, and has undoubtedly greatly hindered gooseberry cultivation. Unlike the comparatively harmless native, or European, gooseberry mildew, which is practically confined to the leaves, the American disease attacks the shoots and berries, so that the whole crop may be rendered worthless in May and June.

In the first years following its introduction to Ireland, attention was concentrated on attempts to exterminate the new disease. These unfortunately have proved quite unsuccessful, and the time has gone by when any hope whatever can be held out of this being accomplished. The disease must therefore be accepted, with most of our other crop pests, as an enemy likely to be encountered almost wherever gooseberries are grown, and efforts must now be directed to keeping it in check. Fortunately, closer experience of the mildew has gradually brought to light better means of controlling it; and as has been the case in the past, a disease which appears incurable on its first appearance is later brought within bounds without much difficulty.

This paper gives the results of the first attempts, extending over the years 1925 to 1929, inclusive, to work out control measures for the disease in the Irish Free State. The experiments are divided into two series, one carried out in the years 1925, 1926 and 1927 on the same plantation at Mount Melleray, Co. Waterford; and the other carried out in various counties by Horticultural Instructors in 1927, 1928, and 1929.

Spraying Experiments at Mount Melleray in 1925.

In July, 1924, a gooseberry plantation containing about 250 bushes, at the Cistercican Abbey, Mount Melleray, Co. Waterford, was found to be apparently in the last stages of a severe attack of American gooseberry mildew. The disease had, it was learned, been present during at least two years, and probably much longer. During this period, the crop had gradually been reduced to a vanishing quantity, no fruit at all being secured in 1924, and very little in 1923. The bushes were in a starved and feeble condition, no new growth having been made for a year or two. An attack of gooseberry sawfly (*Pteronus* (*Nematus*) *ribesii*) had also been a contributory factor.

Although the plantation appeared to be fit for nothing but grubbing out, it was decided, with the approval of the Department of Agriculture, to attempt to save it, and to determine if, under the severe conditions existing,

healthy crops could be produced. The isolated position of the plantation, its remoteness from other gardens or orchards, and the consequent slight risk of spreading the disease were factors which were considered in arriving at this decision. Encouragement in this undertaking was provided by the results of earlier experiments in Holland, in which plantations which had produced no crops worth picking for several years on account of this disease, were induced by means of appropriate spraying to give abundant yields of comparatively healthy berries.*

The author is indebted to the Lord Abbot and Community of Mount Melleray for permission to carry out the experiment on their property, and for help in the progress of the work; also to the Itinerant Instructor in Horticulture for Co. Waterford for his willing co-operation in attending to all practical details.

Preliminary treatment was begun in September, 1924, by "tipping" the shoots, that is, removing and burning the tips of branches which were obviously browned and diseased, particularly those produced in the current season. As there had been practically no new growth, however, it is probable that little infecting material was removed by this operation.

In view of the severe attack, it was decided to spray the whole plantation, using three different treatments, but leaving no untreated plot. It was feared that to leave a control plot in close proximity to the sprayed ones would jeopardise the practical results aimed at. It is a constant problem in experimental work on plant disease control, whether or not to leave an untreated area for comparison, for it cannot be denied that by doing so, one renders control more difficult. Furthermore, where several treatments are to be compared, it is difficult to dispose of the controls in such a way that all the treated plots are equally influenced by them, and many experimenters believe that in such cases control areas should be eliminated. The difficulty is, of course, in direct proportion to the spreading power of the disease in question. As it turned out in this case, spraying proved so unexpectedly efficacious that untreated plots might have been included without great risk; and they were in fact included during the two following seasons' work.

The spraying materials selected for trial were lime-sulphur, ammonium polysulphide, and an alkaline Burgundy mixture containing 1½ lb. of crystalline copper sulphate and 4 lb. of crystalline sodium carbonate (washing soda) in 10 gallons of water.(1) The ammonium polysulphide was manufactured according to the second (1919) formula of Eyre and Salmon,(2) and was guaranteed to contain 21.9 per cent. of polysulphide sulphur.

The sprays were applied just before and just after blossoming. It had been intended to apply a third spray at a later date, but the second was delayed so long owing to weather conditions that, in the almost total

* Maarschalk: In Report of International Conference of Phytopathology, Holland, 1923, p. 119.

(1) This is equivalent to Maarschalk's *(loc. cit.)* "alkaline Burgundy mixture," containing 1·5 per cent. each of copper sulphate and (anhydrous) sodium carbonate, crystalline sodium carbonate, $Na_2 CO_3 . 10 H_2O$, containing 37 per cent. of the anhydrous salt.

(2) Eyre and Salmon: Journ. Ministry of Agr. and Fisheries (England), vol. 26, pp. 821-822, 1919. See also vol. 22, pp. 1118-1125, 1916; vol. 23, pp. 1098-1100, 1917; vol. 25, pp. 1496-1499, 1919.

absence of disease, later spraying was found unnecessary. Further details of the treatments will be found in the following table (Table I.):—

TABLE I.—RESULTS OF EXPERIMENT AT MOUNT MELLERAY IN 1925.
(*Crop picked on June 18th,* 1925).

Plot	No. of Bushes	Fungicide (1)	Strength	Applications No.	Applications Dates		Healthy crop lbs.	Per cent. of total crop diseased
1	55	Ammonium polysulphide and soft soap (0·5 per cent.)	1 : 200	2	23/3/'25	11/5/'25	58	0·5
2	80	Lime-sulphur	1 : 60	2	23/3/'25	11/5/'25	83	0·7
3	90	Alkaline Burgundy (2) ..	1·5%	1	23/3/'25	—	40	0·6
		Lime-sulphur	1 : 100	1	—	11/5/'25		

(1) In addition, arsenate of lead paste was used separately at the rate of 1 lb. in 25 gallons of water on June 18th (after the crop was picked) to control sawfly larvae.

(2) The Burgundy mixture used gave rise to some scorching of the foliage after the first application, and a special trial with it on six bushes on May 1st again produced some burning. Its use was, therefore, discontinued, lime sulphur 1 in 100 being applied instead. The third plot, therefore, had two different treatments.

All the plots contained an approximately equal area, but on account of irregularities in spacing, each contained an unequal number of bushes. In picking the berries, the bushes on the line separating two adjacent plots were neglected, but otherwise the whole crop was picked and graded.

All the fungicides used in 1925 gave practically perfect control of American gooseberry mildew on the fruit, there being no noticeable difference between them in this respect. Even the berries which did show a trace of disease were only slightly affected, and many of them would pass for healthy under ordinary examination. At the time the crop was gathered the control of mildew on the foliage and shoots was nearly perfect also, it being impossible to find any disease, except very occasionally on the new growth. As a consequence, the whole plantation took on a general appearance of good health, and new growth began to be made for the first time for some years. As the season advanced, the disease became more evident on the tips of the young shoots, and by mid-October many of them had become browned or even killed back for a few inches. Nevertheless, the general appearance of the plantation was very satisfactory, and gave promise of an early return to full vigour.

The crop produced in 1925 was approximately one pound per bush in the first and second plots, and less than half a pound in the third, where the bushes were smaller and more closely planted as well as being of a poorer type. In considering these low figures, the previous history of the plantation has to be remembered. It should also be remarked that it is situated on poor mountain soil at an elevation of about 800 ft. above sea level, at the extreme local limit of cultivation.

Spraying Experiments at Mount Melleray in 1926.

The experiment was continued in the year 1926 on the same plot of gooseberries. In the interval, a considerable number of bushes had been

removed, as the ground was overcrowded, but the plot covered the same area as before.

In view of the unexpectedly successful results in 1925, it began to appear probable that the disease could be controlled without great difficulty, and it only remained to work out the details. Attention was, therefore, concentrated on the determination of the number of applications of a standard fungicide capable of controlling the disease most economically. Lime-sulphur (1 :100) was chosen as a standard, on the basis of the previous year's results, to which a commercial " spreader " was added.

During the course of the previous year's experiment, considerable want of uniformity was discovered in the plantation, in which, however, several fairly homogeneous areas existed. Two such areas were selected on which to carry out the present experiment in duplicate, one containing susceptible and fairly prolific bushes, and the other resistant bushes of a non-productive type which could not be identified. The prolific bushes consisted mainly of Whinham's Industry, Amber, White Lion and Careless, planted in lines, across which the plots were arranged. In most cases six bushes were present in each plot, but in some only five were available. All results are calculated on the basis of six-bush plots.

Preliminary treatment was given as before in the previous autumn by " tipping," that is, removing the tips of the shoots, particularly those which were mildewed. The disease was general over the plantation at this time.

Spraying was carried out at three periods—(1) just before flowering on March 2nd, at which time the bushes were very forward and developing rapidly, but, on a cold spell setting in, the opening of the flowers was delayed until the end of March, and the application might have been postponed to the last week of March, which is the more usual time; (2) just after flowering (April 30th); and (3) 25 days later (May 25th). No dormant or winter spraying was practised. The total crop of every plot was picked green for preserving on June 30th and the following day, and all of it was graded. The results are given in Table II.

TABLE II.—RESULTS OF EXPERIMENT AT MOUNT MELLERAY IN 1926.

(*Crop picked on June 30th and July 1st*, 1926).

Sub-plots	No. of Bushes	Fungicide (1)	Strength	Applications				Plot A 1		Plot A 2	
				No.	Dates			Healthy crop lbs.	Per cent. total crop diseased	Healthy crop lbs.	Per cent total crop diseased
1·1	6+6	Lime-sulphur	1 : 100	3	2/3/'26	30/4/'26	25/5/'26	28	0·6	7	0·0
2·2	6+6	do. ..	do.	2	2/3/'26	30/4/'26	—	40	1·1	7·5	0·2
3·3	6+6	do. ..	do.	2	—	30/4/'26	25/5/'26	39·5	2·2	6·5	0·0
4·4	6+6	Control ..	—	0	—	—	—	27	22·2	8·5	1·8
5·5	6+5	Lime-sulphur	1 : 100	1	—	30/4/'26	—	43·5	2·2	10	0·2
6.6	6+5	do. ..	do.	1	2/3/'26	—	—	49	3·0	8·5	0·7

(1) A commercial casein spreader was used throughout at the rate of 2 lb. per 100 gallons of spray.

It is evident that the amount of disease which developed on the low

yielding resistant bushes in Plot A 2 was too small to give significant results (see last two columns of Table II.).

The percentage of diseased berries in Plot A 1 (third last column) is, however, significant. Slightly the best results were secured in Plot 1, which had three applications of spray; but these were not very much better than those of the plots (Nos. 2 and 3) which had two applications. So far as the time of application of the two sprays is concerned, there is little to choose between spraying just before and just after blossoming, on the one hand, and just after blossoming and again about three weeks later, on the other (compare Plots 2 and 3). Even one application, whether made just before or just after blossoming, gave surprisingly good results (Plots 6 and 5) only 3.0 and 2.2 per cent., respectively, of mildewed fruit being found. The control (untreated) plot showed 22.2 per cent. of diseased berries, indicating a very moderate outbreak in that year.

It may be concluded that, under the conditions existing in this plantation in 1926, one application of lime-sulphur 1:100 (with a spreader), gave excellent commercial control; two similar applications were slightly better: and three practically eliminated the disease on the berries. The actual times of application appeared of little consequence, but it is probable that the first, or pre-blossom, spray was the least effective.

The effect of the treatments remained visible until the end of the year. The disease developed on the tips of the new shoots on all the plots, but it was noticeably worst in October on the control plot.

The remainder of the plantation was used in this year for two further duplicate experiments, in one of which lime-sulphur was compared with ammonium polysulphide, and in the other the effect of adding certain " spreaders " to lime-sulphur was tried. Owing, however, to the fact that the bushes were for the most part resistant (though commercially worthless), and to the mixture of susceptible and resistant bushes in one area, no definite conclusions could be drawn. Good control of the disease was secured throughout, and so far as could be seen ammonium polysulphide at strengths of 1:200 and 1:250 showed no advantage over lime-sulphur at strengths of 1:60, 1:100 and even 1:150. The same calcium caseinate spreader was used with both sprays. Neither spray had any appreciable effect on the foliage.

The substances used in combination with lime-sulphur 1:100 to make the spray spread better on the foliage (" spreaders ") were skim, or separated, milk used at the rate of 0.75 gallons per 100 gallons spray, flour paste at the rate of 5½ lbs. per 100 gallons, and a commercial casein spreader at the rate of 2 lbs. per 100 gallons of spray. No outstanding advantage followed the use of any of these materials, but the amount of mildew which developed was not sufficient to show up any small differences which might have been present.

The addition of a spreader adds appreciably, in the case of the commercial article, to the cost of the spraying mixture, and in any case it complicates its preparation. Unless clear advantage accrues from its use, it cannot be recommended; and so far as a conclusion can be drawn here, the addition does not appear necessary.

Spraying Experiments at Mount Melleray in 1927.

Although the disease had been found so unexpectedly easy to control in 1925 and 1926, all the fungicides used proving about equally effective, almost independent of the time of application, it was considered safer to repeat the experiment in 1927 before publishing the previous results. The expectation that different circumstances might be encountered was not disappointed, for the intensity of attack experienced in that year was little short of phenomenal in comparison with the two previous ones, and the protective measures employed were put to a very severe test. For that reason, the results of this experiment are all the more valuable, although the same almost complete degree of control was not attained.

Profiting by previous experience, the work was practically confined to the portion of the plot which was uniformly planted with high-yielding and comparatively susceptible bushes. These consisted as before, of Whinham's Industry, White Lion and Careless (Amber being omitted), across the lines of which the plots were uniformly arranged. The other varieties were avoided altogether, as no results capable of interpretation had ever been secured from them.

The object of the experiment in this year was again to determine the optimum number of applications, and the best time to make them. Spraying was carried out at the same periods as in former years—namely, just before and just after blossoming, and again about three weeks later. The number of applications varied from one to three. The total crop of each plot was picked and graded on July 1st, 1927, with the results shown in Table III.

TABLE III.—RESULTS OF EXPERIMENT AT MOUNT MELLERAY IN 1927
(*Crop picked on July 1st, 1927*).

Plot	No. of Bushes	Fungicide (1)	Strength	Applications No.	Dates			Healthy crop lbs.	Per cent. total crop diseased
1	5	Lime-sulphur ..	1 : 100	3	21/3/'27	2/5/'27	27/5/'27	22·5	13·4
2	5	do. ..	1 : 100	2	—	2/5/'27	27/5/'27	14·75	49·6
3	5	do. ..	1 : 100	1	—	2/5/'27	—	8·25	67·3
4	5	Control ..	—	0	—	—	—	2	88·9
5	5	Lime-sulphur ..	1 : 100	1	21/3/'27	—	—	2	90·4
6	5	do. ..	1 : 100	2	21/3/'27	2/5/'27	—	8·25	70·3
7	5	do. ..	1 : 60	2	21/3/'27	2/5/'27	—	16·75	52·4

1 In addition "Katakilla" was used on June 21st to control sawfly larvae.

The amount of disease on the untreated plot was 88.9 per cent.—with the exception of one bush, which appeared to have some natural resistance and which produced some healthy fruit, every berry without any exception was black with mildew. A more severe attack has never been encountered.

Compared with this, the application of one spray before blossoming (Plot 5) was entirely without effect. When a single spray was applied, however, after blossoming (Plot 3), the amount of disease was reduced to 67.3 per cent. Two sprays, both applied after blossoming (Plot 2), still further

reduced the disease to 49.6 per cent.; but when one of the two was applied before blossoming (Plot 6), the effect was not nearly so good (70.3 per cent. of disease). This is further evidence that the pre-blossom spray is comparatively ineffective. The best result was secured where three sprays were applied, the diseased crop being reduced to 13.4 per cent. One of these applications was made before blossoming, and was presumably without much effect. On the other hand it was evident from the way the disease progressed from the end of May onwards, that if this spray had been reserved until June, much better results might have been expected. This course was successfully pursued in the following year, as will be seen. Finally it will be noted that, comparing Plots 6 and 7, increasing the strength of lime-sulphur from 1:100 to 1:60, effected considerably better control, but the increase is attended by danger of foliage injury.

In spite of the increased amounts of disease compared with the two previous years, the measure of mildew control effected by three applications of spray, compares favourably with that secured with any other fungus disease. The amount of disease which develops in spite of the best commercial spraying is often much more in the case of potato blight, and sometimes of apple scab—diseases which are universally recognised as amenable to control by spraying. The attitude of mind which looks on American gooseberry mildew as incapable of control in this way is no longer justified. If the three seasons during which spraying was conducted at this centre may be taken as representative of the usual range of climatic conditions, it will be seen that in two of them almost perfect control was secured (upwards of 97 to upwards of 99 per cent. of a clean crop) by one or two applications of spray; while in the third, three applications saved 86 per cent. of the crop, and allowed of a full yield being produced.

Effect of three years' treatment on the Gooseberry Plantation at Mount Melleray.

The primary object in view in undertaking work at Mount Melleray was to see if the plantation could be saved and brought back to fruitfulness, as a result of which it was sprayed in its entirety in 1925. Although this object was somewhat departed from in 1926 and 1927, some plots being left unsprayed and many different treatments of varying value introduced, it is still possible to observe how the productiveness (and incidentally the vigour) of the bushes increased. The following figures show the total yields of healthy berries which were secured from 1924 to 1926:

	Yield of healthy fruit from whole plantation in lbs.	Average healthy crop per bush
1924 (before treatment) ...	0	0
1925	181	0·8
1926	544	2·9

The yield of the whole plantation was not taken in 1927, but those bushes, to the number of 82, the crop of which was weighed (these being the most productive) gave exactly the same average total yield (4.2 lb. per bush) as the same bushes gave in 1926. It is evident that no further improvement had been effected. *It follows, therefore, that as a result of two years' spraying the plantation had been brought from a state of barrenness to the full productive capacity possible under the existing circumstances.* That this yield is still low, is due to the nature of the soil and the elevation, and is not material to the question at issue. Concurrently with the increased crop, the bushes, which appeared to be in a starved and half-dying condition in July, 1924, gradually improved in health and general appearance, and were ultimately making vigorous new growth. Although the mildew developed to some extent on these growths during the latter part of the summer and autumn of each year, it did not impair the general appearance of vigour, or apparently interfere to any extent with the following year's crop.

Experiments carried out by certain Instructors in Horticulture in 1927.

A uniform series of experiments was conducted at 17 centres in 1927 by the Itinerant Instructors in Horticulture for the following 9 counties, namely, Dublin, Galway, Kildare, Kilkenny, Louth, Meath, Waterford, Wexford, and Wicklow, whose co-operation the author wishes to acknowledge.

These experiments were planned to determine the number of applications of spray necessary to control the mildew, and the best time to make them. The fungicide used was the same throughout, namely, lime-sulphur, and it was considered advisable to use a somewhat high concentration (1 in 60). No spreader was added. Owing to unavoidable circumstances comparable figures were secured from eleven experiments only, further details of which will be found in the annexed Table IV.

As will be seen in Table IV., there was practically no disease in the experiment in Co. Dublin. In nine of the ten remaining experiments, the plot which received three applications showed good control of the disease. The other case (Kildare Experiment No. 2) was not so good, but it was noted that the 50 per cent. of infection recorded here for this plot was of a mild type, and not of the same order as the 100 per cent. of infection in the control, where the berries were useless. The application of two sprays, as compared with three, led, as a rule, to a notable increase in the amount of disease; while with one application, the amount was still further increased in most cases. Nevertheless, the untreated plot shows a much higher percentage throughout.

Experiments of this nature are carried out under considerable difficulties, and do not lend themselves to exact analysis. On the other hand, they have the advantage of showing the results likely to be secured by the general public under everyday conditions. The principal difficulty in this case sprang from the absence of uniform commercial plantations, making it necessary to resort to private gardens, in which it is almost impossible to lay out a good experiment, and very difficult to obtain control of fungus diseases.

TABLE IV.—RESULTS OF EXPERIMENTS CARRIED OUT BY INSTRUCTORS IN HORTICULTURE, 1927.

Lime-sulphur 1 : 60 used throughout.

(Crops picked at normal times—dates varied).

County	Exp. No.	No. of bushes per plot	Total Weight of Crop (lb.): Sprayed 3 times—*Before and after blooming and 3 weeks later*	Total Weight of Crop (lb.): Sprayed twice—*Before and after blooming*	Total Weight of Crop (lb.): Sprayed once—*After blooming*	Total Weight of Crop (lb.): Not Sprayed	Per Cent. Total Weight Mildewed: Sprayed 3 times—*Before and after blooming and 3 weeks later*	Per Cent. Total Weight Mildewed: Sprayed twice—*Before and after blooming*	Per Cent. Total Weight Mildewed: Sprayed once—*After blooming*	Per Cent. Total Weight Mildewed: Not Sprayed
Dublin	1	56	36¼	61¼	57½	51¼	0·2	0·8	0·4	1·0
Kildare	1	25	56¼	75	118½	40¼	12·5	12·5	55·2	100·0
... ...	2	9	74	148	91½	63	50·0	50·0	51·7	100·0
Kilkenny	1	24	34½	33½	35½	34½	1·4	4·5	21·1	30·4
Louth	1	12	42	43	45	36	15·7	28·1	53·3	83·3
Wexford	1	6	60	60	60	54	0·0	5·0	5·0	11·1
... ...	2	3	30	30	29	30	10·0	10·0	24·1	33·3
Wicklow	1	6	15½	81½	52¼	14½	0·0	0·1	1·4	100·0
... ...	2	5	14¼	14¼	6½	8¾	0·0	0·9	19·2	90·5
... ...	3	6	42¾	35¾	27¾	25	1·8	12·6	26·1	95·0
... ...	4	5	14¼	12¼	11	6½	0·0	35·0	31·8	100·0
Average percentages of disease							8·3	14·5	26·3	67·7

It is believed, notwithstanding this, that the average percentages of infection shown in the table above express with sufficient accuracy the effect of the application of one, two, and three sprays, respectively. The result may be interpreted as follows:—Compared with an average of over 67 per cent. of infection in the untreated plots, three applications of spray gave the best control, reducing the disease to just over 8 per cent. The least effective spray appears to be the first, or pre-blossom, one. The post-blossom (or second) spray was probably the most effective individually, and where it and the third were applied, the amount of disease was reduced to less than 15 per cent. The third spray, while still effective, was probably less so than the second. Its use alone resulted in over 26 per cent. of infection, against 67 per cent. in the control. These results, it may be remembered, were secured in a year in which the disease was more than usually severe.

There were, as stated, six experiments carried out from which no figures are available. Two of these were considered by the respective Instructors to show almost perfect control when three sprays were applied; while in two others no apparent improvement was noted, even as a result of three sprayings. The absence of figures, however, invalidates the results. No conclusion can be drawn from the remaining experiments, owing to unequal distribution of the disease and other causes.

Experiments carried out by certain Instructors in Horticulture in 1928.

The experiments were repeated on a uniform plan at 12 centres in 1928, but in a modified form. Acknowledgments are due to the Itinerant Instructors in Horticulture for the following counties—Galway, Kildare, Kilkenny, Louth, Wexford, and Wicklow, who were responsible for all the details.

Lime-sulphur was again employed as the standard fungicide, but the strength used was reduced to 1:100, which had already been found successful for several years at Mount Melleray. Using this material, the effect of making one, two and three applications at different periods was tried. In view of the conclusion tentatively arrived at in 1927, that the post-blossom sprays were more important than the pre-blossom one, three applications beginning after blossoming were tried against three applications beginning before blossoming. Again, where two applications only were made in 1928, these came after blossoming and about four weeks later; while in 1927 the corresponding plot was treated before and after blossoming. In addition, ammonium polysulphide 1:200 and lime-sulphur 1:60 were compared with lime-sulphur at the standard strength.

Although the mildew was again exceptionally severe in 1928 (probably more so even than in 1927, which was also a bad mildew year), no disease developed in two experiments (Kilkenny and Galway No. 2 experiment), and the results concerning them are excluded. Four experiments in one county were not carried out according to plan, and it is not possible to compare the results with those of the other experiments in tabular form. For this reason, they are also excluded. Further details relating to this series are given in Table V.

TABLE V.—RESULTS OF EXPERIMENTS CARRIED OUT BY INSTRUCTORS IN HORTICULTURE IN 1928.

(Crops picked at normal times—dates varied).

County	No. of Exp.	No. of Bushes per plot	TOTAL WEIGHT OF CROP (LB.)							PER CENT. TOTAL WEIGHT MILDEWED						
			LIME-SULPHUR 1 : 100				L.-s. 1 : 60	A.P.S. 1 : 200	CONTROL	LIME-SULPHUR 1 : 100				L.-s. 1 : 60	A.P.S. 1 : 200	CONTROL
			Sprayed 3 times—*After blooming and 3 and 6 weeks later*	Sprayed 3 times—*Before and after blooming* and 4 *weeks later*	Sprayed twice—*After blooming and* 4 *weeks later*	Sprayed once—*After blooming*	Sprayed 3 times—*Before and after blooming and* 4 *weeks later*	Sprayed 3 times—*Before and after blooming and* 4 *weeks later*	Not sprayed	Sprayed 3 times *After blooming and 3 and 6 weeks later*	Sprayed 3 times—*Before and after blooming and* 4 *weeks later*	Sprayed twice—*After blooming and* 4 *weeks later*	Sprayed once—*After blooming*	Sprayed 3 times—*Before and after blooming and* 4 *weeks later*	Sprayed 3 times—*Before and after blooming and* 4 *weeks later*	Not sprayed
Galway ...	1	6	54	43	71	70	— (1)	25	65	0·0	25·6	35·2	41·4	— (1)	60·0 (2)	90·8
Louth ...	1	1	4	3⅝	4½	5¾	4½	4⅝	4⅜ (3)	1·5	3·4	11·1	39·1	0·0	2·7 (2)	68·6(3)
	2	1	10¼	—	4	7½	18	3	8¼ (4)	7·3	—	0·0	0·0	0·0	8·3 (2)	81·8(4)
Wexford	1	6	112½ (5)	122½	132	148½	132	120	125½	1·3 (5)	2·0	8·0	6·9	4·5	15·0	34·7
Wicklow ...	1	6	4⅛	3½	3¾	6¼	6	2½	3¼	0·0	2·8	5·1	24·0	0·0	0·0	92·3
	2	6	74⅝	24⅝	63¾	47¼	55⅝	80¼	31½	0·0	0·5	1·6	15·3	2·9	0·0	95·2
Average percentages of disease										1·7	6·9	10·2	21·1	1·5	5·0 (6)	77·2

(1) The crop was sold off early and at that time was said to show no disease.

(2) This plot had only two applications, the pre-blossom spray being missed.

(3) This figure is the average of six bushes, one corresponding to each treated bush.

(4) This figure is the average of five bushes, one corresponding to each treated bush.

(5) The third spray was applied six weeks after the second spray instead of after the first (July 10th instead of middle of June).

(6) Omitting three experiments in which the full number of applications was not made.

The results shown in Table V. are relatively very uniform (particularly considering the difficulties of the case already referred to), and the average percentages of disease shown in the last line are probably reliable. It will be seen that three applications of spray after blossoming reduced the percentage of disease from 77.2 to 1.7. When three sprays were applied, it was distinctly better to put them all on after blossoming, rather than to put one on before blossoming. This bears out the experience in this particular in 1927. Two sprays, one immediately after blossoming and the other four weeks later, reduced the diseased crop to 10.2 per cent., while a single spray reduced it to 21.1 per cent. on the average. It is evident that, as appeared to be the case in the previous year, the post-blossom spray is individually the most effective, followed by the succeeding sprays. The pre-blossom of spray may apparently be omitted without incurring any risk.

Comparing lime-sulphur 1:60 with the standard strength of lime-sulphur (1:100), it appears that the stronger mixture of lime-sulphur reduced the amount of disease to 1.5 per cent., against 6.9 per cent. in the plot similarly treated with the weaker mixture. Whatever advantage there may be in this, however, is more than counterbalanced by an increased tendency to scorch the leaves, and even to cause them to fall, on such varieties as Whinham's Industry, Keepsake, and others, which are not affected by the weaker spray. Consequently lime-sulphur is not to be recommended at a strength of 1:60. Injury to Amber varieties was very severe.

The experiment with ammonium polysulphide 1:200 was not satisfactory, and this plot may possibly have been subjected to somewhat more infection than the others from its proximity to the control. The conclusion arrived at in previous years, however, that it does not possess an outstanding advantage over lime-sulphur appears to be again justified. According to the Instructors' notes, it produced about as much scorching and dropping of the leaves of Amber varieties as did lime-sulphur 1:100. From the points of view of simplicity, and also economy, therefore, lime-sulphur is to be preferred.

Experiments carried out by certain Instructors in Horticulture in 1929.

The experiment as conducted in 1928 was again carried out in 1929 at ten centres in five counties—namely, Galway, Kildare, Louth, Wexford, and Wicklow, by the local Instructors in Horticulture.

Of the ten experiments, highly successful control of the mildew was recorded in five, and moderately successful in one, as is shown in the following table. The remaining experiments miscarried for various reasons.

TABLE VI.—RESULTS OF EXPERIMENTS CARRIED OUT BY INSTRUCTORS IN HORTICULTURE IN 1929.

(Crops picked at normal times—dates varied).

COUNTY	Exp. No.	No. of Bushes per plot	TOTAL WEIGHT OF CROP (LB.)							PER CENT. TOTAL WEIGHT MILDEWED						
			LIME-SULPHUR 1 : 100				L.-S. 1 : 60	A.P.S. 1 : 200	CONTROL	LIME-SULPHUR 1 : 100				L.-S. 1 : 60	A.P.S. 1 : 200	CONTROL
			Sprayed 3 times—*After blooming and 3 and 6 weeks later*	Sprayed 3 times—*Before and after blooming and 4 weeks later*	Sprayed twice—*After blooming and 4 weeks later*	Sprayed once—*After blooming*	Sprayed 3 times—*Before and after blooming and 4 weeks later*	Sprayed 3 times—*Before and after blooming and 4 weeks later*	Not sprayed	Sprayed 3 times—*After blooming and 3 and 6 weeks later*	Sprayed 3 times—*Before and after blooming and 4 weeks" later*	Sprayed twice—*After blooming and 4 weeks later*	Sprayed once—*After blooming*	Sprayed 3 times—*Before and after blooming and 4 weeks later*	Sprayed 3 times—*Before and after blooming and 4 weeks later*	Not sprayed
Kildare ...	1	22	68	70	66	58	57	84	53	5·9	11·4	9·1	17·2	10·5	3·6	62·3
,, ...	2	8–15	14·5	10	12·75	10·5	9	11·75	16	17·2	20·0	21·6	33·3	33·3	14·9	68·7
Louth ...	1	6	13·25	—	13	15	11·25*	10·25*	11	1·9	—	15·4	20·0	11·1*	2·4*	95·4
,, ...	2	6	8	—	9·25	10·5	9·75*	10*	8	6·2	—	13·5	23·8	7·7*	5·0*	75·0
Wicklow ...	1	6	66·25	73*	72	46·75	63·25*	74·25*	43·25	1·9	3·4*	5·2	9·1	1·6*	0·3*	89·0
,, ...	2	6	67	67·5	66·25	59·5	72	65·25	52·5	0·0	0·0	0·8	2·5	2·4	1·5	92·4
					Average percentages of disease	...	...			5·5	[8·7]	10·9	17·6	11·1	4·6	80·5

* Two applications only. The pre-blossom spray was missed.

Comparing the results with those shown in Table V., the similarity is evident, although the degree of control secured in 1929 was not so complete. The outbreak of disease in the latter year was exceptionally severe. Nevertheless, three applications of spray after blossoming reduced the disease on the average from 80.5 per cent. to 5.5 per cent., and provided, as in previous years, the best control of the disease. Two applications after blossoming reduced the attack to 10.9 per cent., and one similar application reduced it to 17.6 per cent. The difficulties of carrying out experiments in small gardens have already been emphasised. It is probable that under commercial conditions much better control would be secured as a result of the same number of applications.

It is not possible to compare the effects of spraying before and after blossoming in 1929, owing to the fact that pre-blossom spray was deferred or missed altogether in a number of cases, but there is no indication that it had any appreciable effect in preventing the mildew from developing, any more than in previous years.

In one respect the results differ from those of 1928, namely, in the better control secured with ammonium polysulphide. Comparing Plot 6 (A.P.S. (1:200) and Plot 2 (L.S. 1:100), neither of which was situated next the control plot, the former shows almost uniformly somewhat lower percentages of disease, and on the average the difference is considerable. It is to be noted, however, that the average for Plot 2 is probably unduly high, as the full series of experiments is not represented. In former years no appreciable difference could be found between lime-sulphur and ammonium polysulphide, and it would be unwise to generalise too far from an isolated experience.

Apart from these experiments a certain number of trials were carried out by other Instructors, generally with satisfactory results. It is now evident after three years' experience that a conviction has grown up among those taking part in the work that the disease can be controlled quite well by spraying, and that something is wrong with the method in cases in which good results are not secured. This conviction is worth a good deal, and is striking contrast with the general state of mind only a few years ago.

Cost of Spraying.

An accurate account was kept of the cost for materials in the case of the principal fungicides used at Mount Melleray in 1925 and 1926, the prices charged for the raw ingredients being those actually paid at the time.

[TABLE

TABLE VI.—COST OF SPRAYING MATERIALS IN 1925 AND 1926.

Fungicide	Strength	Spreader	Strength	Cost per Diluted Gal. of Spray			Avg. applic. per bush	Avg. Cost per Application	
				Fungicide (d)	Spreader (d)	Total (d)	(gal.)	Without spreader (d)	With spreader (d)
Ammonium polysulphide ..	1 : 200	Soft Soap	0·5%	1·05	0·60	1·65	0·25	0·26	0·41
Lime-sulphur	1 : 60	—	—	1·00	—	1·00	0·25	0·25	—
Lime-sulphur	1 : 100	Casein	0·2%	0·60	0·54	1·14	0·25	0·15	0·285
Lime-sulphur	1 : 100	Skim-milk	0·8%	0·60	0·02	0·62	0·25	0·15	0·155
Lime-sulphur	1 : 100	Flour paste	0·6%	0·60	0·06	0·66	0·25	0·15	0·165
Alkaline Burgundy ..	1·5%	—	—	0·56	—	0·56	0·25	0·14	—

As will be seen from the annexed table, the cost for materials for 1 gallon of diluted spray varies from 1.05d. in the case of ammonium polysulphide to 0.56d. for the alkaline Burgundy mixture, lime-sulphur 1:100 costing 0.60d. The addition of spreaders may raise the total cost to a figure varying from 1.65d. to 1.14d. per gallon, but a skim-milk spreader can be added to lime-sulphur 1:100 at negligible expense, making the total cost 0.62d. per gallon. Using this material, it will be seen therefore that, at the rates of application used, a bush may be sprayed three times for less than one half-penny. This figure leaves out of account the cost for labour, not to speak of the trouble and foresight necessary in procuring materials, and these, if not the biggest item in the total cost, are certainly the greatest deterrents to spraying. It was not possible to keep an account of labour in this experiment, but it is calculated that it might have cost 0.2d. per bush per application. On such an assumption, the cost for labour and materials to spray a medium-sized bush three times with lime-sulphur 1:100 would be (0.6d.+0.45d.), or a total of just over 1d. per bush for the season. The corresponding charge for a bush of full size would be about 2d. or a little less, which is about equal to the price of 1 lb. of fruit. Mature bushes usually produce 15 to 20 lbs. of fruit in the season.

Discussions and Practical Recommendations.

So far as fungicides are concerned, lime-sulphur 1:100 proved itself quite efficient against mildew, and on the score of cost, easy procurability, and simplicity is recommended for all varieties except the Amber sorts. Ammonium polysulphide, at a strength of 1:200 also proved itself about as good a fungicide, and may be used if desired. Both have about the same effect on foliage, and at the strengths mentioned were used with perfect safety on all varieties tried, with the exception of Ambers or Sulphurs.

There does not appear to be any real necessity to add a spreader to the spray. No doubt such an addition might bring about a certain increase in efficiency (which, however, could not be measured in these experiments),

but the same is true of other diseases in the control of which spreaders are not usually used. If desired, however, skim-milk may be added to lime-sulphur at the rate of $\frac{3}{4}$ gallon to 100 gallons of spray. In the case of ammonium polysulphide, soft soap is used at the rate of $\frac{1}{2}$ lb. per 10 gallons.

As to the time of application, a good deal of evidence has been presented to show that the pre-blossom spray, which is usually applied in the last week of March, is less effective than the later ones. It appears indeed safe to conclude that spraying need not under ordinary circumstances be begun until after blossoming (about May 1st). If spraying is begun about that date, and three applications are made at intervals of three weeks, or so, it appears probable from these experiments that even the most severe attacks can be reduced to small proportions, so far as the fruit is concerned. In less severe attacks, the last, and even the second last application also, may be omitted with safety; but caution is necessary on this point, particularly when picking is done late. The dates of picking in the experiments here recorded (which are given in every case) were postponed to the normal time.

The spraying programme just outlined is applicable to plantations maintained for fruit production. It does not prevent the development of mildew on the tips of the new shoots later in the season, but this does not appear to interfere with crop production, and can be dealt with by "tipping." In the case of young bushes, however, later applications may be necessary, either to ward off the disease altogether or to control an outbreak.

Although no evidence was sought for as to the value of "tipping," or the removal of the tips of the shoots in Autumn, this practice was generally employed in addition to spraying. General experience seems to show that it is to be recommended.

Summary.

This paper records the results of two series of spraying experiments in connection with the American gooseberry mildew (*Sphaerotheca mors-uvae*), one of which was carried out at the same place at Mount Melleray, Co. Waterford, in 1925, 1926 and 1927, and the other at various centres in different counties in 1927, 1928 and 1929.

The disease, owing to climatic conditions, was possibly somewhat below average intensity in 1925, and was certainly below the average in 1926, but was very severe in 1927, 1928 and 1929.

The experiment at Mount Melleray was first undertaken in order to determine if a plantation containing about 250 bushes which was in a sterile and moribund condition in 1924, due mainly to the American mildew, could be saved. This result was effected within two years by means of spraying, the total crop of healthy fruit being increased from nothing in 1924 to 181 lbs. in 1925, and 544 lbs. in 1926. The improvement was maintained in 1927, but no further increase resulted.

In the three experiments at Mount Melleray, lime-sulphur was used as the standard spray, first at a strength of 1:60 and later at 1:100, which

was found effective. The former has a greater fungicidal value, but is more liable to injure the foliage. Three applications of spray were required to control the severe outbreak of 1927; but two applications or even a single one, gave almost complete control in the former years. The pre-blossom spray appeared less effective than the post-blossom ones.

Ammonium polysulphide 1:200 was about as effective as lime-sulphur 1:100, but showed no outstanding advantage. "Alkaline Burgundy mixture" was found to be unsuitable owing to the injury caused to the foliage.

The addition of a "spreader" to the spraying mixture did not appear to be necessary.

The results are also given of eleven experiments in six counties in 1927, of six experiments in four counties in 1928, and of six experiments in four counties in 1929, all carried out by the County Instructors in Horticulture.

Good control was obtained in almost every case. Three sprayings reduced the diseased crop from 67.7 per cent. to 8.3 per cent. on the average in 1927. In 1928 three similar sprayings reduced the disease from 77.2 per cent. to 6.9 per cent. on the average.

In both of these cases one of the applications was made before blossoming, and appeared to be comparatively ineffective. The effect of three applications beginning after blossoming was tried in 1928, with the result that the diseased crop was still further reduced to 1.7 per cent. Similar results were obtained in 1929.

The cost of spraying was determined as accurately as possible in 1925 and 1926 at Mount Melleray. The cost for materials and labour of spraying one medium-sized bush three times with lime-sulphur 1:100 was found to be about 1d. The cost for a full-sized bush may be estimated at about 2d.

For general use lime-sulphur 1:100 (or ammonium polysulphide 1:200) is recommended, up to three sprays being applied beginning after blossoming. Tipping should be practised in addition early in September. Later spraying may be necessary in the case of young bushes.

MOLE DRAINING.

Report on Trials Conducted at the Agricultural School, Ballyhaise.

By D. Delaney, A.R.C.SC.I.

The practice of drainage and its advantages are well known to every Irish farmer, but the cost of stone or tile drains, or any method which involves the digging of trenches by manual labour, frequently renders the work uneconomic.

There are extensive tracts of stiff, clay soils all over the country, where the relatively new and comparatively cheap system of mole draining could be employed to great advantage. This system has not, as yet, been practised to any great extent in this country, although it has given satisfactory and lasting results under certain conditions elsewhere.

The work is performed by a specially designed plough fitted with a cutting disc and a strong, knife-edged coulter, to which is attached an iron cartridge or mole, from $2\frac{1}{2}$ to 3 inches in diameter. The coulter may be adjusted to any suitable depth. In hauling the plough along the surface the mole or " sock " at the end of the coulter is forced through the soil, thus making a small tunnel or drain $2\frac{1}{2}$ inches to 3 inches in diameter and capable of draining off water immediately, provided there is sufficient fall and that a proper outlet is provided.

The rainfall in many districts in Ireland during recent years has been above the average, with the result that, in many instances, heavy soils which should be capable of producing high quality natural grasses have practically gone to waste owing to the excessive growth of rushes. Such conditions prevail notably in Counties Cavan, Monaghan and Leitrim. Repeated cuttings at short intervals and close grazing will, no doubt, help to keep rushes in check, but their presence may be regarded as due to insufficient drainage and, under such conditions, it is claimed that the mole drain plough serves a very useful purpose provided the ground is not too stony. Tests on this type of land (heavy soil) have recently been carried out at the Department's Agricultural School, Ballyhaise, and the following notes on the conduct of the work and the results so far obtained may be of interest.

Season 1926.

A pasture field about 6 acres in extent was mole drained in the Spring and Autumn of 1926. The soil was a stiff clay, comparatively free from stones, lying on a very hard impervious subsoil. Rushes and coarse grasses constituted the principal herbage. A Wells mole plough as illustrated was used and the drains were cut 4 feet apart to a depth of about 12 inches. Horses were first employed for haulage, but it was found that even three horses were unable to haul the outfit when operating at a satisfactory depth. A Fordson tractor (old type) was found more satisfactory, but the tractor was unable to haul the plough, particularly when the surface was wet, at a greater depth than 12 inches.

Seasons 1927 *and* 1928.

Further work, using the same plough, was carried out during the seasons 1927 and 1928. The soil was similar to that drained in 1926. The field selected had been meadowed for a number of years and grazed in the Autumn and early Spring in the usual manner. It was necessary each year before the land was drained to mow off the rushes in early Spring when the field was being closed off for hay.

The moles, 10 inches deep and 5 feet apart, were made across the slope of the field and run into a main drain which was cut across the ends of the moles after the latter had been made. The stiff subsoil would not allow of the tractor hauling the plough at a greater depth than 10 inches and in no case was it possible to work the plough against the hill.

Season 1929.

During the Spring of 1929 the mole drain plough was employed on a more extensive scale. The land was in rough pasture covered with a strong growth of rushes, and was very wet all through the Winter months. The rushes were cut off previous to draining.

Mole drains, six feet apart, were run across the slope of the field. Very few obstacles were met with and in a few instances where stones obstructed the course of the plough, the latter was merely lifted over the obstacle and again continued in its course. The moles were so close together that it was considered a few obstructions would not interfere to any great extent with the general efficiency of the draining.

In some cases the moles were considered too long and auxiliary main drains were cut across them at intervals of about forty yards. These main drains were about two feet deep and were laid with 3-inch pipes or tiles. The pipes were covered with stones to a depth of a few inches. At the points where the moles entered the auxiliary main drains the stones covered the pipes to a greater depth and were carefully built round each inlet so as to prevent the moles becoming choked by loose clay. The auxiliary mains entered the main drain at a suitable angle and the inlets were also well protected by stones to prevent choking.

The following were the principal items of expenditure incurred during the season in the mole-draining of a 9 acre field, the moles being made 6 feet apart and 11 inches deep.

The tractor (Fordson) operated by driver and an assistant performed the work in three days during which time 24 gallons paraffin, 1 gallon petrol, and 3 gallons of lubricating oil were consumed. With labour at 6d. per hour, the cost of the main drain and auxilaries, 400 yards long, including the carting and laying but excluding the cost of the tiles, was 2s. 7d. per perch. The tiles cost 3s. 9d. per perch.

Results and General Observations.

1. There were noticeable improvements following the making of the mole drains, but the permanency of these improvements will depend on the duration of the drains. It is not possible to say how long the drains will last, as

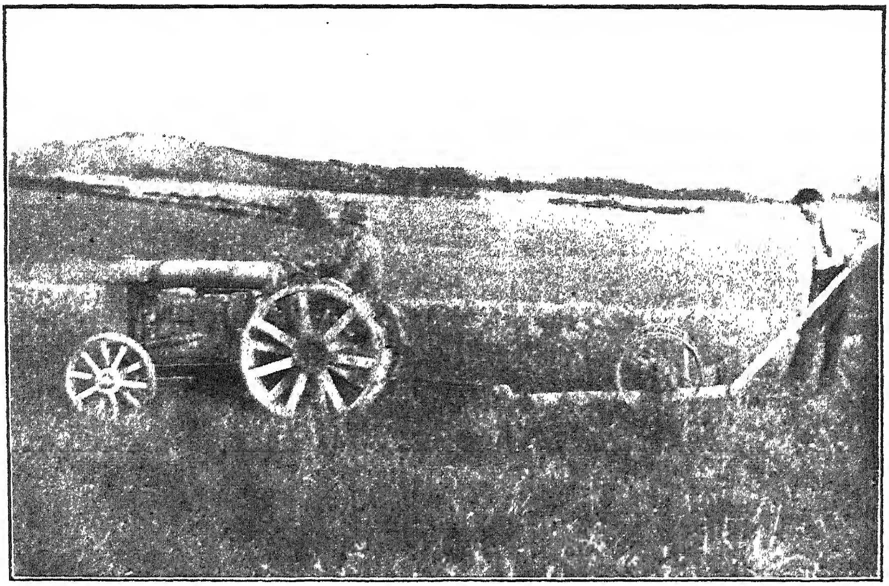


Fig. 1. Mole Plough at Work.

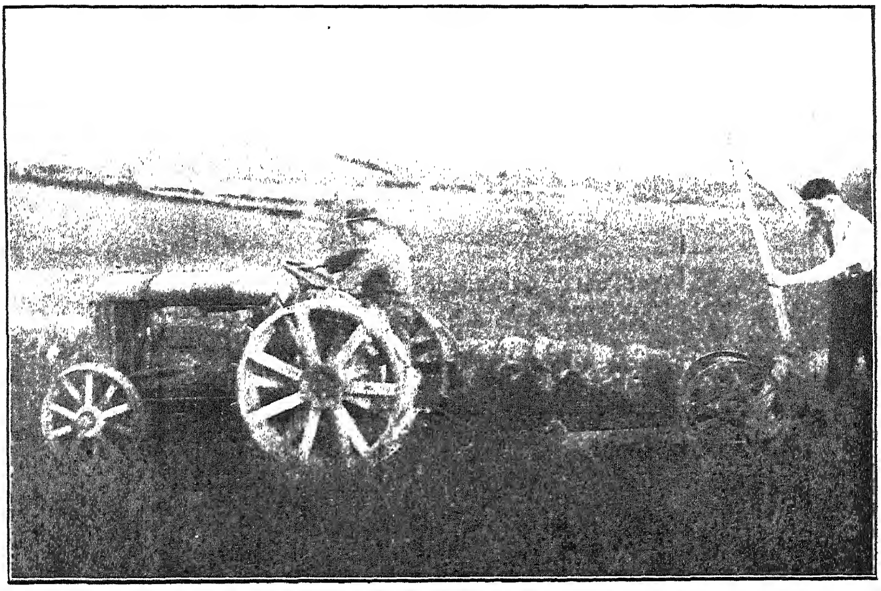


Fig. 1. Mole Plough entering the Ground.

much depends on the nature of the soil, the depth and distances apart of the moles, the position of the main drain and the efficiency of the precautions taken to prevent the choking of the moles at the entrance to the main drain.

2. It was observed that, as a result of the mole draining in 1926, 1927 and 1928, the land so treated was comparatively dry and firm under foot immediately following a heavy fall of rain. Where, however, the land was badly cut up by cattle the moles did not work satisfactorily.

3. The land, mole drained in 1927 and 1928, was comparatively free from rushes in the Spring of 1929 and it was not necessary to have them cut previous to closing the field for hay, as was found necessary in previous years.

4. It was found that the Fordson tractor required reasonably solid ground in order to work satisfactorily even when the plough was set to cut moles to a depth of only 12 inches, and that it was not capable of hauling the plough against the slope of the hill in a stiff soil.

5. It was considered advisable, owing to the stiff nature of the soil and the risk of the drains becoming choked, that the moles should not be more than 6 feet apart.

As a result of these trials it is evident that mole draining is worth a trial in this country. The drains may prove, perhaps, not as lasting as well made tile or stone drains, but mole draining can be repeated at a comparatively small cost. In certain counties it may be possible to hire a tractor and plough to perform the work, just as threshing sets are being hired at present.

THE ACIDIFYING INFLUENCE OF SOME ARTIFICIAL FERTILIZERS, AND THE CAPACITY OF THE SOIL TO RESIST ACIDIFICATION.

By Patrick H. Gallagher, D.Sc., Ph.D. (Cantab.), *Faculty of Agriculture, University College, Dublin.*

It is generally recognised that certain fertilizers have an appreciable influence on soil reaction. Some, such as sulphate of ammonia, or sulphate or chloride of potash, are known to be capable of rendering the soil acid, while others, such as nitrate of soda or basic slag are believed to make it more alkaline. The importance to plant growth of soil reaction, or hydrogen-ion concentration, has been discussed in a previous publication (5). The present paper deals with an experimental investigation of some of the factors which control soil reaction.

The investigation, of which an account is given in this paper, arose primarily out of some observations made on the soil of the Stormanstown pasture plots, to some of which relatively heavy dressings of sulphate of ammonia have been given during the past two years. Of the artificial fertilizers in common use, sulphate of ammonia is regarded as that which tends to produce greatest soil acidification, so much so, that it is commonly considered essential to supplement applications of sulphate of ammonia by liming, in order to prevent the accumulation of acid in the soil. Although total applications of sulphate of ammonia to the extent of eight hundredweights per acre have already been added at the Stormanstown farm attached to the Albert College, yet though no supplementary liming has been carried out, the ammonia treated plots are still no more acid than the control plots on which no ammonia has been used.

At first sight a result of this nature might be interpreted as disproving the prevalent belief that sulphate of ammonia is capable of inducing soil acidification. The true explanation, however, is that the soil at Stormanstown has merely proved itself capable of resisting acidification. In other words, it is what is termed a highly "buffered" soil.

The "Buffer Capacity" of the Soil.

The term "buffer capacity," as applied to soils, has but little current use in agriculture, so that a brief explanation would seem advisable. By the "buffer capacity" of a substance we mean its power to resist changes of hydrogen-ion concentration. The term, in other words, represents the ability of a substance to resist acidification or alkalinization. When a soil is treated with sulphate of potash or with sulphate of ammonia, the plant utilises the potash or ammonia, but leaves most of the sulphuric acid to be dealt with by the soil. The neutralisation by the soil of a strong acid, such as

sulphuric or nitric, is not strictly akin to the neutralisation of these acids by an alkali, because a virtual neutralisation still takes place even though the soil be originally an acid one. Certain soil constituents such as carbonates, clay or humus are, or behave as, salts of very weak acids. When these are treated with a strong acid, the latter combines with their basic constituents, thereby displacing an equivalent quantity of very weak acids. The weak acids thus liberated in the soil are either volatile, as in the case of carbonic, or nearly insoluble, as in the case of clay or humus, and in any event, their influence on hydrogen-ion concentration is comparatively negligible, particularly when compared to that of the strong acid which has displaced them.

It is therefore on the extent to which basic material is combined with readily displaceable weak acids that a soil will be capable of resisting the action of acidifying fertilizers. In this respect, soil carbonates, humus and clay are of highest importance.

The term "buffer capacity" equally applies to the property of an acid soil to resist neutralisation by an alkali and the property is of importance in this connection when determining lime-requirement. This aspect of the question, however, will be reserved for separate treatment.

A knowledge of the capacity of the soil to resist acidification is of particular importance at the moment because of the increasing and more intensive use of sulphate of ammonia as a fertilizer, and in view of the fact that in so far as sulphate of ammonia induces soil acidity it tends to impede its own efficiency, since acid conditions retard the nitrification process which is essential in rendering this fertilizer available as a plant food.

An attempt has been made in the present work to estimate the extent to which the soil of the Stormanstown pasture plots might be expected to resist acidification in the absence of lime treatment. The results show that of itself, an annual application of four hundredweights of sulphate of ammonia could not cause any acidification in this soil unless continued for considerably more than half a century. It would be very erroneous to infer that all other soils could resist acidification to the same degree. From observations made, it is evident that the Stormanstown soil tends to remain in a neutral condition mainly because of its carbonate content, although its content of the latter substance cannot be said to be abnormally high. The results obtained suggest that only a fraction of the carbonate ordinarily included in soil analyses is truly effective in maintaining soil neutrality. Before proceeding to experimental details, the extent of the influence of some of the more common artificial fertilizers on soil reaction will be briefly reviewed.

THE INFLUENCE OF FERTILIZERS ON SOIL REACTION.

A substance added to the soil may exert an influence on soil reaction either through an initial acid or alkaline reaction possessed by the substance, or because of transformations taking place in the soil resulting in the production of acid or of alkali. Among fertilizers, superphosphate enters the first classification in so far as it possesses a considerable initial acidity, while salts of ammonia and potash mainly manifest acidity because of subsequent transformation. The plant, in utilising salts of ammonia and potash,

preferentially makes use of the basic constituent, leaving the acid radical in the soil. Moreover, the necessary conversion of ammonia to nitrate involves the production of nitric acid by bacterial agencies. Salts of potash and ammonia are denoted as physiologically acid, because the acidity resulting from their use depends on the intervention of physiological agencies. Sulphur is likewise physiologically acid because it is readily oxidized by certain soil bacteria to sulphuric acid.

In the same manner, substances such as nitrate of soda, though initially neutral, may undergo transformation in the soil resulting in the production of free base. Such substances are classed as physiologically alkaline. On the other hand, a substance like liquid manure may be initially alkaline because of the presence of free ammonia or other organic bases, but under conditions of efficient nitrification it may prove to be physiologically acid in the soil because of the production of nitric acid.

These considerations furnish a brief resumé of the theoretical aspect of the effect of fertilizers on soil reaction. In view of the buffer capacity of the soil it will be of interest to explore to what extent they can be said to apply as serious factors to acidity in the field.

Sulphate of Ammonia.

Field trials designed to study the influence of salts of ammonia on soil reaction have repeatedly been carried out. They appear to yield general agreement that ammonium salts increase acidity. The subject has been specially studied over a number of years both at Rothamsted and at the Rhode Island Experimental Station. Hall and Gillingham (6) at Rothamsted, Hunt (8) at Pennsylvania and Ruprecht and Morse (16) at Massachusetts, each obtained results which indicate that ammonium salts increase soil acidity. That the use of ammonium salts depletes the soil's supply of base is evident from the observation made at Rothamsted, where, from a calculation made on the lime contents of plots after 40 years' interval, it was found that the ammonia-treated plots lost calcium carbonate at the rate of 1,100 lbs. per annum, while plots treated with nitrate of soda instead of ammonia only lost carbonate at the average rate of 565 lbs. Morse (11) at Massachusetts, likewise observed that the carbonate lost from the soil on which sulphate of ammonia was used was nearly twice the amount lost when the nitrogenous fertilizer was nitrate of soda.

Salts of Potash.

The general results of field experiments with potash salts indicate acidifying action, though the effect observed in this case appears to be distinctly less than with sulphate of ammonia. Skinner and Beattie (17) for instance, find that sulphate of potash increases the "lime-requirement" of the soil, while Plummer (13) observed a distinct increase in hydrogen-ion concentration due to the same fertilizer. The latter author states, however, that the increase was decidedly less than when the same soil was treated with sulphate of ammonia. Plummer attributes the difference to the nitric acid developed from ammonia by the soil organisms.

Phosphatic Manures.

While there is general agreement that rock phosphate is without influence on soil reaction or on "lime-requirement," the effect of treating the soil with superphosphate has been the subject of considerable controversy. The preparation of superphosphate involves the treatment of rock phosphate with sulphuric acid. In the resulting fertilizer, however, this acid is found combined in the form of calcium sulphate. The tricalcium phosphate of the original rock is simultaneously converted mostly into mono-calcium phosphate. While dicalcium phosphate is nearly neutral, mono-calcium phosphate is a distinctly acid salt. The hydrogen-ion concentrations of two samples of good commercial superphosphate examined by the author were found to be as high as pH 1·4 and pH 2·1 respectively. Superphosphate must therefore be considered a manure which is initially very acid, and this fact helps to explain the common belief that this fertilizer acidifies. Strange as it may seem, the bulk of the evidence fails to support this belief. While Thorne (18), and Hartwell and Pember (7) hold that treatment with superphosphate increases soil acidity, Conner (2) in observations made at Indiana found that plots which had been treated with superphosphate for 20 years were less acid than control plots which received none of this fertilizer. Veitch (19) likewise reported that superphosphate causes a slight reduction in soil acidity, and Brooks (1) obtained a similar result with dissolved bones.

The estimations of soil acidity by many of the authors just quoted were made by various chemical lime-requirement methods which cannot always be regarded as either consistent or reliable, and much of the confusion regarding the effect of superphosphate on the soil is clearly due to this cause. Hartwell and Pember, for instance, estimated acidity by extracting the soil with calcium acetate solution and titrating the extract. Mirasol (10) found that by adopting this procedure the result indicated an increase in acidity, while if the extraction be made by means of a solution of potassium nitrate the result indicated a reduction in acidity. The determination of hydrogen-ion concentration, on the other hand, affords an accurate and fundamental measurement of acidity and the results arrived at by this method uniformly indicate *that the use of superphosphate is without any substantial permanent influence on soil reaction*. Plummer, at North Carolina, found that plots which had received rather heavy annual applications of superphosphate for 15 years (the total amount applied being over 3,000 lbs. per acre) did not show any different pH values from those used as controls, while considerably increased acidity was recorded at the same place on plots which had been treated with sulphates of potash and ammonia. Morse (11) from observations made on field plots at Massachusetts found that unlimed soils showed but little effects as a result of treatment with superphosphate and potassium chloride, while sulphate of ammonia increased the hydrogen-ion concentration considerably. Crowther (3), at Rothamsted obtained similar results, and Karracker (9), found that neither rock phosphate nor superphosphate had any appreciable effect on soil pH.

Erdman (4), who experimented on both acid, neutral and on alkaline soils, found that sulphate of calcium which is present in abundance in superphosphate, is without any influence on soil reaction. It is known, however,

that calcium sulphate can moderate the alkalinity of excessively alkaline soils. That a distinctly acid substance, such as superphosphate, should be without any permanent acidifying influence is clearly explicable on the grounds that the acidity initially displayed by this fertilizer is due to partially free phosphoric acid which is utilised by the plant and which in any event readily enters almost insoluble combinations with various soil constituents. There seems very little doubt, however, that when freshly applied to the soil a temporary acidification may result. On soils which are originally very acid this would be disadvantageous; on other soils it might prove an advantage.

Basic Slag.

Basic slag, on the other hand, is initially quite alkaline. A typical sample of the slag at present on the market was found to have a reaction of nearly pH 11. The alkalinizing action of basic slag is undoubtedly permanent in character. Its chief active constituent is a complex silicate, or rather silico-phosphate, of calcium; and calcium when combined in this form seems comparable to calcium carbonate as a "buffering substance". It has been known for a considerable time that calcium in the form of silicate is just as effective as calcium carbonate in the treatment of acid soils. Rice Williams (20) found that basic slag is almost as effective as lime in increasing both the exchangeable calcium and the degree of saturation of acid soils, but its effect on hydrogen-ion concentration was not quite so marked as that of lime.

EXPERIMENTAL.

The Stormanstown Pasture Plots.

At the beginning of 1927 a number of plots were laid down by Professor Drew on pasture-land at Stormanstown in order to test the intensive system of pasture-land fertilization. The manner in which these plots have been arranged may be seen by reference to Figure 1.

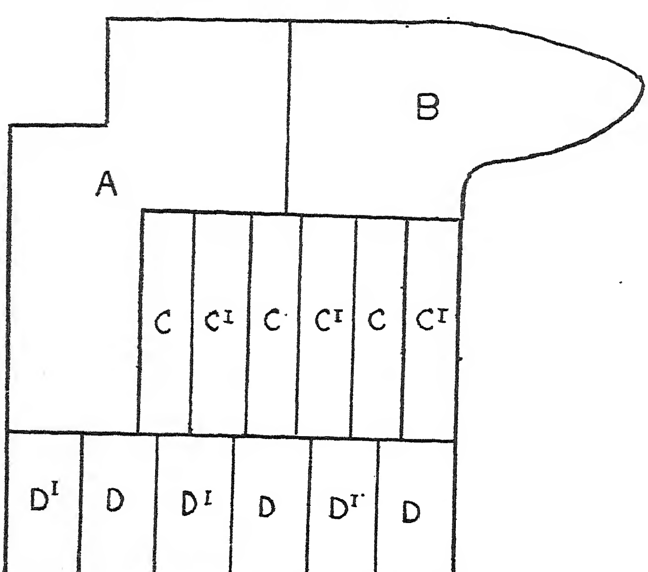


Figure 1.—Plan of Stormanstown pasture plots.

The plot marked A served as an unmanured control. B received 4 cwts. of superphosphate and 3 cwts. of kainit, and was submitted to continuous grazing. The plots marked C received the same manures as B, but were submitted to rotational grazing. The plots marked C¹ were also grazed in rotation, but received 4 cwts. of sulphate of ammonia per acre in addition to superphosphate and kainit. D and D¹ were plots which received the same treatments as C and C¹ with the difference that while C and C¹ were on permanent pasture, D and D¹ were on temporary.

When the pasture experiment was originally laid down the field as a whole was regarded as being of uniform character. It is to be regretted, however, that no soil samples were taken before the manures were first applied. The first series of samples were lifted in November, 1927, six borings being made in each plot or series of plots, which had received the same manurial treatment. The results of hydrogen-ion concentration measurements made on the united samples from each type of plot are given in Table 1.

Plot	Manurial treatment	pH of surface 9″ (composed of six samples)	pH of subsoil (composed of six samples)
A	Control	7.39	7·48
B	4 cwts. superphosphate ... ... 3 cwts. kainit	6.97	7·34
C	4 cwts. superphosphate ... ... 3 cwts. kainit ... ... (Rotational grazing)	7·22	7·72
C¹	4 cwts. superphosphate ... ... 3 cwts. kainit ... ... 4 cwts. sulphate of ammonia ... (Rotational grazing)	7·44	7·77
D	Same as C ... ... (Temporary pasture)	7·49	7·69
D¹	Same as C¹ ... ... (Temporary pasture)	7·56	7·63

TABLE I.—SHOWING HYDROGEN-ION CONCENTRATIONS OF STORMANSTOWN PLOTS AT END OF FIRST SEASON.

The results shown in Table 1 reveal no acidification due to sulphate of ammonia at the end of the first season. It will be observed, in fact, that the plots treated with sulphate of ammonia are appreciably more alkaline than the contiguous plots which received no ammonium salt. However, in the absence of readings for the same soils before the manures were applied, an attempt to draw deductions from such variations as are apparent between the different plots would scarcely be justified.

In the second season of the pasture experiment (1928) the manurial treatment was varied to the extent that basic slag was substituted for superphosphate, and on half of the plots to which sulphate of ammonia was applied during the previous year nitro-chalk was used instead. At the end of the

second season the procedure was adopted of making the soil-acidity estimation on each individual boring. The values obtained for the surface soils are shown diagrammatically in Figure 2.

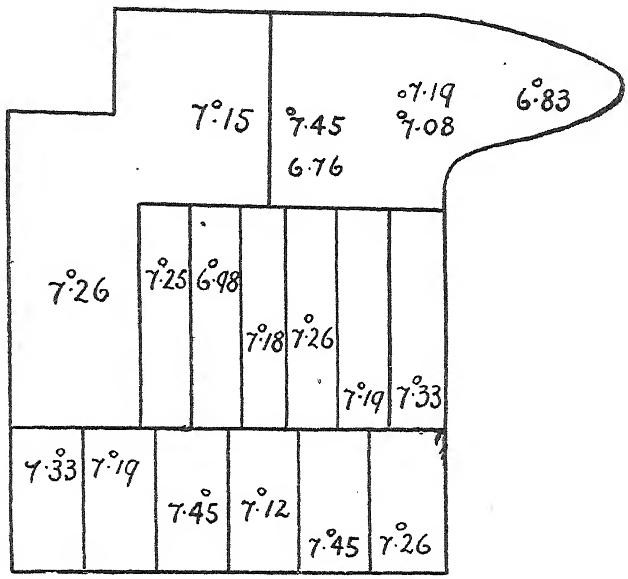


Figure 2.—Showing the soil reaction at different parts of the Stormanstown pasture plots at the end of the second season.

The results shown in Figure 2, taken in conjunction with those obtained at the end of the previous season, show clearly that the manurial treatments given to this soil, although they might possibly have been expected to alter the soil reaction, have in reality, made no significant difference whatsoever. When we come to consider the question of supplementary lime applications, it is obviously a matter of importance to know to what extent a soil can resist the action of physiologically acid manures. The laboratory experiments to be described further on were devised to determine the extent and nature of this resistance in the soil in question.

Laboratory Investigation on the Resistance of Stormanstown Soil to Acidification.

In order to test the resistance of the soil to acidification the procedure adopted consisted in treating definite amounts with measured quantities of acid and subsequently estimating the resulting soil acidity. It is obviously necessary to choose an acid which will approximate most in its action to acidification under field conditions. Due consideration of the matter led to the choice of sulphuric acid in these experiments, for the following reasons: (*a*) it is the acid which most frequently remains in the soil after artificial fertilizer treatments and (*b*), unlike hydrochloric or nitric acids, it yields the

relatively insoluble calcium sulphate, which substance has itself no appreciable influence on soil reaction (Compare Erdman (4)).

In a series of laboratory experiments, occupying merely weeks or months, it is obviously impossible to exactly simulate processes which take place in the soil over many years under natural conditions. While due allowance should be made for the inevitable divergence from natural conditions in the interpretation of the following experiments, it will none the less be apparent that the results obtained reveal an important property of the soil from the point of view of artificial fertilization.

Experiment I.

10 gr. portions of the air-dried fine surface-soil (which passed the 1 m.m. sieve) from plot A were treated in open beakers with different quantities of a "normal" solution of sulphuric acid (4.9% H_2SO_4). Distilled water was added in each case so as to make a soil-water ratio of 1 : 4. The contents of each beaker were thoroughly stirred a couple of times each day during the period through which the experiment lasted. At the end of the first week hydrogen-ion concentration measurements were made on these acid treated soils with the results shown in Curve I, Figure 3 (page 216).

It will be seen that no acidification of the soil takes place until more than 4 c.c. of 4·9% sulphuric acid has been added. Acidification is then relatively gradual until about 6 c.c. of acid has been added. Thence onward, acidification is relatively rapid, as shown by the steep downward trend of the curve.

The rate of acidification of pure water by the addition of similar quantities of acid in the absence of soil is shown by Curve 6 Figure 3.

The retarding or buffering influence of the soil is clearly illustrated by the difference between these two curves.

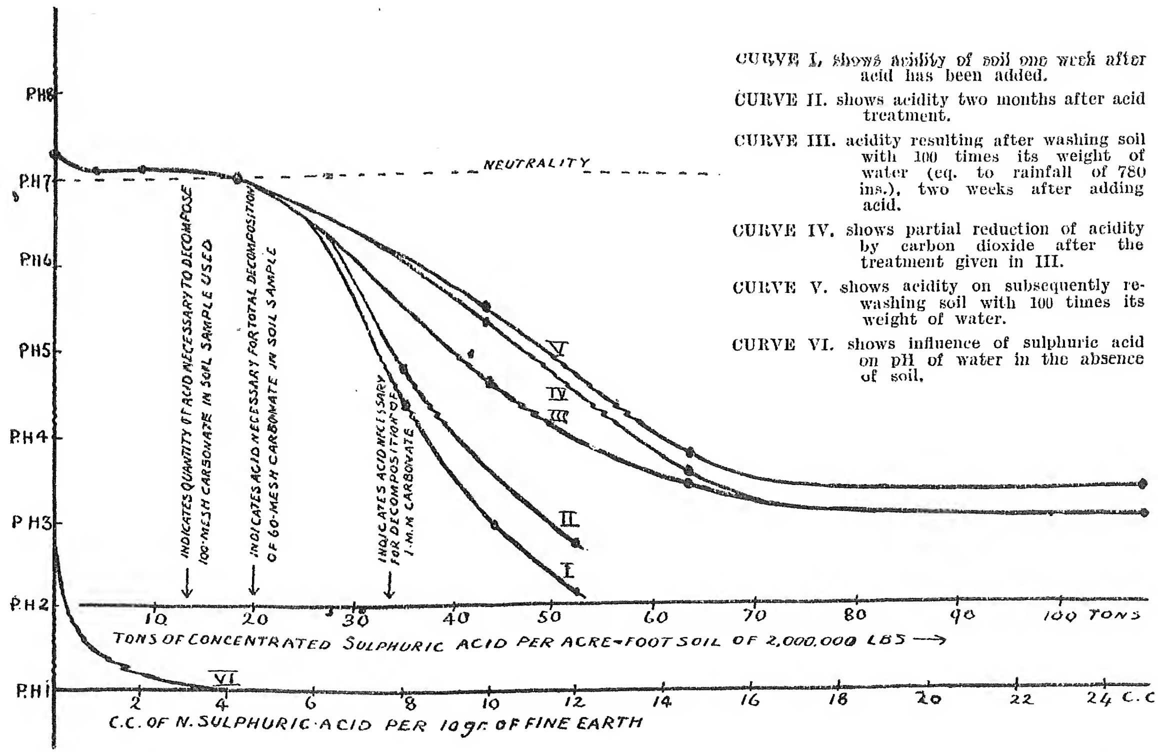


Figure 3.—Showing influence of sulphuric acid on the reaction of the surface soil of the control plot in the Stormanstown pasture experiment.

A simple calculation will serve to show the practical significance of these results. 1 c.c. of normal sulphuric acid contains 0·049 gr. of the pure acid. From the weight of a known volume of the fresh soil it was calculated that the weight of air-dried fine earth in an acre to the depth of one foot was 1,957,500 lbs. This does not include stones and gravel which amounted to 11·3% of the original air-dried soil. Taking the weight of an acre-foot of air-dried fine earth at the round conventional figure of 2,000,000 lbs., it will be seen that the addition of 0·049 gr. of acid to 10 gr. of soil is equivalent to the addition of 9,800 lbs., or 4 tons, 8 cwts. of acid per acre. It would therefore be necessary to add more than seventeen tons of concentrated sulphuric acid per acre before this soil would cease to be neutral at the end of a week. To supply this quantity of sulphuric acid, more than 23 tons of sulphate of ammonia would be required. We must, however, extend consideration beyond the sulphuric acid liberated from the sulphate. When the ammonia is nitrified in the soil an equivalent amount of nitric acid is produced and the rate of acidification by sulphate of ammonia would consequently be double that of the sulphuric acid which it contains. Taking this also into consideration, it is evident that regular applications of sulphate of ammonia at the rate of 4 cwts. per annum would, of themselves, produce no appreciable acidification of the soil under examination in a period of nearly sixty years. That this is a conservative estimate will be apparent from the results of succeeding experiments and from the fact that the calculation is based on the assumption that the fertilizer confines its action to the surface foot of soil only.

Discussion.

The experiment just described, and the deductions made therefrom, enable us to arrive at an idea of the full chemical potentialities of sulphate of ammonia in bringing about soil acidification. The result is obviously applicable only to the soil on which the experiment was carried out. It is first necessary to seek the physical or chemical property of this soil which is responsible for its resistance to acidification before we can attempt to apply the result to soils in general. It is advisable to remember, moreover, that the experiment in the form just described does not furnish a sufficiently close replica of acidification by sulphate of ammonia under field conditions, because it makes no allowance for factors which might conceivably modify the acidifying action of the fertilizer in the field. Further investigation was therefore deemed essential to ascertain the nature of the soil's resistance to acidification and the influence of climatic and other factors thereon. Subsequent experiments will show that the deductions already made are a minimum, rather than a maximum, estimate of this soil property. It will be seen further on that the acidification produced in the soil by the addition of sulphuric acid decreases (*a*) with time (*b*) with rainfall and (*c*) through the action of substances such as carbon dioxide which help to solubilise residual soil carbonate.

The Reaction of Soil Carbonates.

Calcium carbonate is undoubtedly the constituent most concerned in maintaining the soil in an approximately neutral condition. In certain soils, magnesium carbonate plays a prominent part, and it is important to note that magnesium carbonate tends to produce greater alkalinity than the calcium compound. Under somewhat exceptional conditions, usually met with in arid climates, sodium carbonate often produces relatively intense alkalinity in the soil, but we are not concerned with these abnormal conditions here. In general, it may be said that a soil condition of slight alkalinity or of approximate neutrality is usually found to be associated with the presence of free calcium carbonate in the soil.

In order to understand the influence of calcium carbonate on soil reaction it is necessary to note that pure calcium carbonate is not neutral, but definitely alkaline. The solubility and alkalinity of calcium carbonate both depend on the concentration of carbon dioxide which is present in the solution. A solution of calcium carbonate in equilibrium with the small concentration of carbon dioxide present in the ordinary atmosphere has a hydrogen-ion concentration of pH 8·4. On the other hand, a solution of calcium carbonate completely saturated with carbon dioxide at a pressure of one atmosphere is quite acid at pH 5·8. The atmosphere of the soil is known to be considerably richer in carbon dioxide than the ordinary atmosphere, the values recorded for ordinary arable soils being between the limits of 0·3 and 3·5%. A concentration of 3·35% of carbon dioxide in the atmosphere would be required to render a solution of calcium carbonate neutral. Magnesium carbonate would behave in a manner substantially similar to calcium carbonate, though owing to its greater solubility and its tendency to form basic carbonates, it produces relatively greater alkalinity.

It will now be interesting to examine, from a consideration of its carbonate content, how the soil used in the preceding experiment might have been expected to behave, on treatment with acid. The estimation of carbonate in the Collin's Calcimeter yielded a value of 3·9% as calcium carbonate. To decompose the 0·39 gr. of limestone in the 10 gr. portions of soil used, 7·8 c.c. of normal sulphuric acid would have been necessary. At first sight therefore, it appears perplexing that the acidification of the soil begins considerably before this amount of acid has been added, or in other words, before all of the carbonate could have been decomposed. After contact with 7·8 c.c. of sulphuric acid for seven days the soil is found to remain as acid as pH 4·4. The tests were carried out in open beakers and considering the time which elapsed before pH readings were taken it seems likely that the excess of carbon dioxide liberated from the carbonate had sufficient time to escape from the solution.

An explanation for the apparent inactivity of portion of the soil carbonate which was first considered likely was, that the carbonate particles had become surrounded by a coating of the relatively insoluble calcium sulphate and that they were thus inhibited from further neutralising the acid. The solubility of calcium sulphate in water at ordinary temperatures is about 2·3 parts

per 1,000. If all of the calcium carbonate present in 10 gr. of soil were converted into sulphate, the amount of sulphate present would be 0·53 gr., which would be incapable of entirely dissolving in the 40 c.c. of water present An attempt was therefore made to wash out the calcium sulphate from the soil, with the simultaneous purpose of seeking to simulate and determine the nature of the action of rainfall. The total amount of water used in this second experiment was 1,000 c.c. per 10 gr. of soil. Since 10 gr. of the fine earth from the soil under examination would have a surface area under field conditions of about 0·5 sq. cm., one litre of water passing through this would correspond to a rainfall of 2,000 cm. or 787 inches, which would be nearly equivalent to a rainfall of 28 inches over a period of 28 years.

Experiment 2.

10 gr. portions of Soil A (fine earth) were treated with 5, 10, 15 and 20 c.c. of normal sulphuric acid, respectively, as in experiment 1. Each was allowed to remain fourteen days in contact with the acid and was then mechanically shaken for three hours with 750 c.c. of distilled water, after which it was filtered and washed with distilled water until the filtrate measured one litre. The soil remaining on the filter paper was then washed into a beaker. Distilled water was added to make a soil water ratio of 1 : 4 and the hydrogen-ion concentration was then determined with the results shown in Curve III, Figure 3 (page 216). The Curve numbered II in Figure 3 shows the hydrogen-ion concentration of the soil after standing in contact with acid for two months.

Discussion.

A comparison of curves I and II (Figure 3) shows that the acidity displayed by the soil after standing for one week in contact with sulphuric acid undergoes a very appreciable reduction on standing for two months. Had a much greater length of time been allowed to elapse before hydrogen-ion concentration readings were taken there is no doubt that the acidity resulting from the addition of acid would have been still less. This fact serves to indicate that the deductions made from experiment 1 are essentially of a conservative nature. The extreme slowness with which the soil attains equilibrium after treatment with a very reactive substance such as sulphuric acid deserves special emphasis. There is little doubt that much of the difficulty of soil analysis is due to this relative inertness which is a necessary consequence of the fact that the soil is a solid reagent.

Influence of rainfall.

It is clear from the results obtained by leaching the soil that leaching or rainfall produces a marked diminution in the acidity induced by the addition of sulphuric acid. The more acidic the soil has become through the addition of acid, the greater is the reduction in acidity produced by subsequent washing. It is evident, therefore, that in an acid soil a high rain-

fall would tend to diminish the acidification due to acids liberated in the soil. It is thus to be expected, that under acid soil conditions toxic acidity would be more likely to arise quickly in a dry than in a wet climate from the use of a fertilizer such as sulphate of ammonia. There is an evident difference in this respect between neutral and acid solids. Soil neutrality is ordinarily found to be due to free carbonate in the soil. A high rainfall will hasten the loss of free carbonate and consequently favour the onset of acid soil conditions. The loss of carbonate from calcareous soils is frequently as much as half a ton per acre in the climate of Britain. A loss of this nature must certainly be reckoned with in estimating the capacity of a soil to remain neutral over any considerable length of time, but it is evident that while a high rainfall will thus tend to induce an earlier acidity in a calcareous soil, it will at the same time tend to moderate the influence of acids artificially introduced into a non-calcareous soil.

Solubility of Iron, Aluminium and Silica in Acid Soils.

That the most acidified soil samples should show the greatest diminution in acidity on leaching might reasonably be expected; although the soil shows a very considerable capacity to absorb or neutralise added acid, this capacity must necessarily have a limit beyond which free acid would tend to accumulate. It will be remembered that those who favoured the aluminium theory of soil acidity regard the toxicity of acid soils as being due to soluble salts of aluminium which invariably have an acid reaction (5). In experiments on intensive fertilization with sulphate of ammonia, which were carried out some years ago at the Rhode Island Experiment Station, it was observed that soils which became very acid and sterile through continued use of this fertilizer, in the absence of lime applications, contained considerable amounts of soluble aluminium. The acidification of the soil is known to cause a considerable increase in the solubility of metals such as aluminium and iron. As a matter of interest in this respect the total quantities of aluminium and iron and of soluble silica were estimated in the washings from the soil samples used in experiment 2. In Figure 4 (page 221) the pH values of the soil samples after leaching are plotted against the total quantities of aluminium and iron, calculated as oxides, and the quantity of silica, respectively, which were present in the leachings. The increase in solubility of the elements mentioned with increase in soil acidity is clearly evident. Figure 5 (page 221) gives similar results obtained with an acid soil from over Old Red Sandstone in Co. Fermanagh.

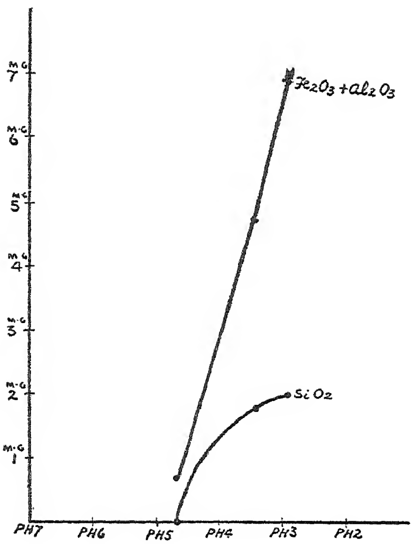


Figure 4.—Showing relation between reaction of Stormanstown soil and solubilities of Iron and Aluminium ($Fe_2O_3 + Al_2O_3$) and Silica (SiO_2) after leaching 10gr. of soil with 100 times its weight of water subsequent to acid treatment. The initial reaction of this soil was pH 7.3.

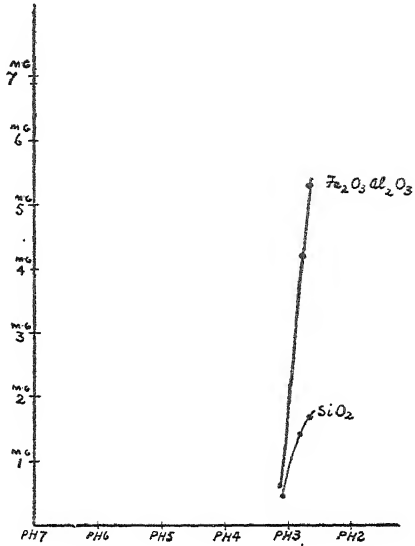


Figure 5.—Results similar to those given in Fig. 4., obtained with a Red Sandstone soil from Fermanagh. This soil was initially acid (pH 5).

The Relation of Soil Carbonate to Neutrality.

In introducing experiment 2, the inefficiency of portion of the soil carbonate to maintain a neutral soil condition on the addition of acid beyond a certain stage was pointed out. The tentative explanation advanced was that portion of the carbonate might be protected by a coating of relatively insoluble sulphate. The dissolving away of the sulphate yields no evidence that the efficiency of the residual soil carbonate has been appreciably increased. Had the carbonate remaining in the soil been completely activated as a neutralising agent after the sulphate had been dissolved something like a break in the curve near neutrality at a point corresponding to the total decomposition of carbonate might have been expected, but there is no evidence of such.

In so far as it may be desirable in agriculture to maintain the soil in an approximately neutral condition, the effectiveness of calcium carbonate to achieve and maintain this condition is undoubtedly of considerable practical importance. Soils as acid as pH 6 are frequently found to contain a certain amount of carbonate and at first sight it is not clear how an easily decomposable alkaline substance can escape decomposition in an acid medium. It is equally clear from the present study that a considerable proportion of the carbonate in the soil under examination is ineffective in preventing the soil from falling below the degree of acidity just mentioned.

The chemical study of the soil is considerably complicated by the fact that the characteristic soil constituents invariably possess an infinitesimal solubility. Fineness of division, in some form, is essential to chemical reaction,

the most effective state of division being attained when a substance is in solution. Calcium carbonate dissolves in pure water to the extent of only about 15 parts per million. The reactivity of calcium carbonate in the soil is no doubt to a very great extent dependent on its increased solubility in presence of carbon dioxide. It was therefore anticipated that treatment of the soil samples under examination with carbon dioxide, in order to facilitate the solution of residual carbonate, should tend to increase the buffer capacity of the soil and so maintain longer a neutral condition in presence of added acid.

Experiment 3.

The residual soil samples from experiment 2, suspended in 40 c.c. of water in flasks, were treated with a current of pure carbon dioxide on a shaking-machine for two hours on each of three successive days. The suspensions were then allowed to stand in open flasks for a couple of days to allow the carbon dioxide present in solution to come to equilibrium with the atmosphere. The hydrogen-ion concentration of each sample was then estimated, with the result shown in Curve IV, Figure 3 (page 216). It will be seen that with the exception of the sample to which 10 c.c. of normal sulphuric had originally been added, the acidities remained substantially the same as before treatment with carbon dioxide. In the case of the exception referred to, a decrease in acidity of 0·7 pH units was observed and a reference to the curve shows that this decrease takes place where relatively inactive residual carbonate might be expected to be most abundant.

Experiment 4.

The procedure adopted in washing the soil samples in experiment 2 was repeated on the samples which had been treated with carbon dioxide. The total washings at the end of this experiment was the equivalent to the leaching action of a rainfall of 28 inches per annum for about 56 years. The resulting acidities are shown in Curve V, Figure 3 (page 216). It will be observed that further leaching of the soil in this case reduced the hydrogen-ion concentrations still further, the maximum acidity attained after washing tending towards a constant value in the neighbourhood of pH 3.

Conclusions from Preceding Experiments.

It is evident from the foregoing experiments that the curve showing the capacity of the soil to resist acidification, which was obtained after simple treatment of the soil with sulphuric acid in experiment I, represents a distinctly minimum value. Since it is well-nigh impossible in a laboratory experiment to exactly simulate the varied processes taking place in soil acidification under field conditions over a long period, it is distinctly valuable that any method adopted in the laboratory to determine the buffer capacity of the soil should be one which yields a really conservative estimate. The experiments just described indicate in a broad general way the manner in which the Stormanstown soil is capable of resisting treatments which are

generally supposed to produce acidification in any soil. An attempt has been made to correlate the carbonate content of the soil with its capacity to remain in a neutral condition on treatment with acid. In the case of the 1 m.m. fine earth used in these experiments no very close quantitative relationship is apparent. That the discrepancy observed is undoubtedly due to the coarseness of structure of a considerable fraction of the limestone particles present in the 1 m.m. fine earth is clearly evident from the acidification curves shown in Figure 6 (page 224). These curves were obtained with samples derived from the same soil as that used in the previous experiments, with the difference that in the present instance the soil fraction used was that which proved capable of passing the No. 100 sieve. In this case the soil remains practically neutral on treatment with acid until sufficient acid has been added to decompose *all* of the carbonate.

Importance of State of Division of Limestone in the Soil.

The preceding observation raises the question as to whether ordinary analyses of soil carbonate do not give an exaggerated idea of the effective carbonate reserves in the soil owing to the inclusion of particles up to 1 m.m. in diameter. The reactivity of a sparingly soluble substance such as calcium carbonate necessarily depends both on its surface area and on the distance between the particles, and these in turn are essentially dependent on the extent to which the substance is physically broken down. When the more insoluble fertilizers, such as basic slag, are applied to the soil the necessity for fineness of division to render them effective is recognised. Slag particles with a diameter of 1 m.m. are regarded as relatively ineffective and it is quite likely that carbonate particles of this diameter are equally so, at least for immediate purposes.

The state of division at which limestone may be reckoned to be sufficiently effective as a neutralising agent in the soil is of importance, not only when we consider the case of lime already present in the soil, but equally so, when it is a matter of liming with ground limestone. The question has already been investigated from this latter aspect by several workers. Runk (15) at Delaware, examined the effect on the soil of limestone of various degrees of fineness. He found 100-mesh ground limestone as effective as burnt lime in every way, but while 60-mesh material was as active as 100-mesh limestone in stimulating the decomposition of organic matter, the former appeared to be inferior in its effect on soil organisms. Morgan and Salter (12) noted that fineness of grinding was of decided importance in overcoming the differences in solubility due to the physical nature of different stones (hardness, etc.). They found that the 100-mesh particles of all the stones examined tend to bring the soil reaction rapidly towards the neutral point.

The acidification curves for the Stormanstown soil already presented clearly illustrate the effectiveness of 100-mesh limestone to maintain the soil in a neutral condition. It must not be inferred, however, that *all* coarser-grained material is to be regarded as useless, because there exists decisive evidence to the contrary. The bulk of the evidence suggests that 60 or 50

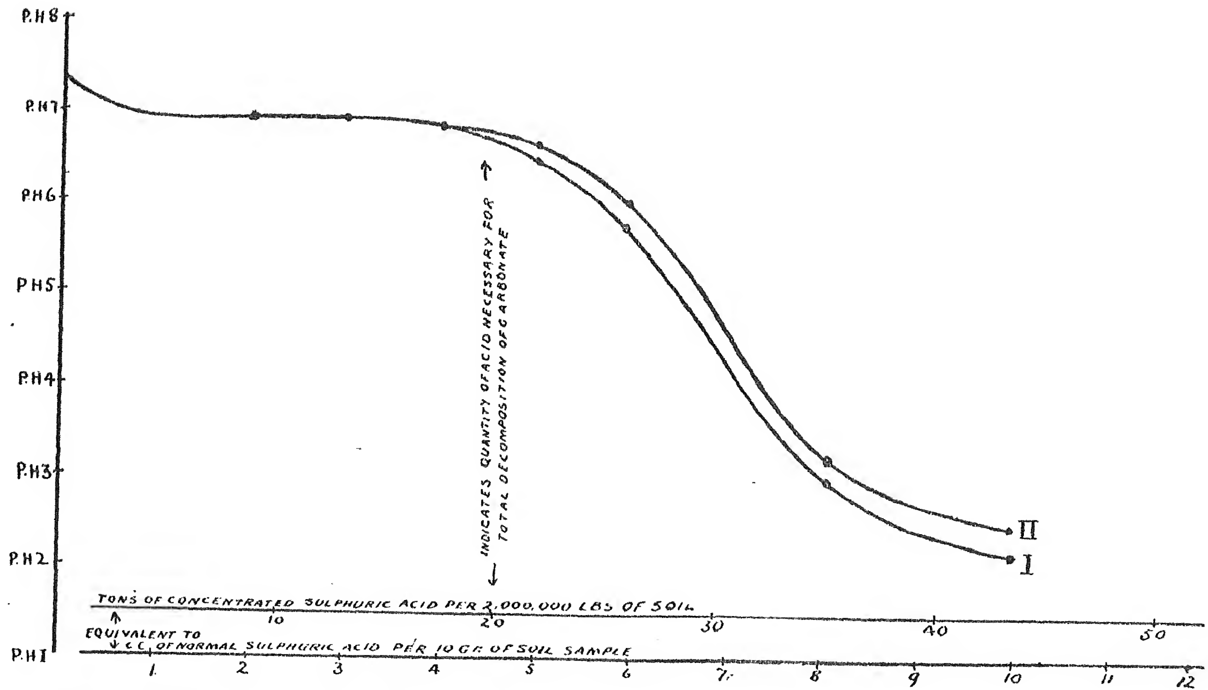


Figure 6.—Showing the acid-resisting character of the 100-mesh fraction of soil A. This fraction remains practically neutral until more acid has been added than that required to decompose all carbonate present.

CURVE I. shows acidity TWO weeks after addition of acid.

CURVE II. shows acidity FOUR weeks after addition of acid.

mesh material represents a sufficient degree of division for all immediate practical purposes. It seems somewhat anomalous, however, that while the importance of fineness of division is generally recognised where liming with ground limestone is practised, the soil analyst on the other hand, very frequently remains content to include particles of 1 m.m. diameter in his estimate of so-called active limestone in the soil. Particles of this nature, however, undoubtedly exert their influence in course of time and their importance in the long run ought by no means to be disregarded.

Buffer Capacity of Soil C^1.

Reference to the Table at end of paper showing the Carbonate content of each of the Stormanstown plots, will indicate that the surface-soil from Plot A, on which the foregoing experiments were carried out, is one of the richest in carbonate, the percentage, calculated as $CaCO_3$ in the 1 m.m. fine earth being 3·92. The surface-soil C^1, on the other hand is nearly the poorest in carbonate, the percentage in the 1 m.m. material being 2·83. The effect of acid treatment on soil C^1 is shown in Figure 7 (page 226). The three curves shown in this figure were obtained (1) two weeks after addition of sulphuric acid : (II) four weeks after addition, and (III) ten weeks after the acid had been added. A considerable diminution in acidity with time, such as that already observed with soil A, is apparent here also. The soil used in the present case begins to acquire an acid reaction appreciably sooner than that which was employed in the previous experiments. This result might reasonably have been expected on theoretical grounds because of the difference in carbonate content of the two samples. In the case of soil C^1 it is again to be noted that acidification begins before sufficient acid has been added to completely decompose the soil carbonate ; it will be observed, moreover, that a considerable percentage of undecomposed carbonate proved incapable of completely overcoming this acidity at the end of the ten weeks during which observations lasted.

It should be noted that of the 3·92% of calcium carbonate present in the 1 m.m. fine earth of soil A only 2·35% proved to be less than 60-mesh fineness. In the case of soil C^1, on the other hand, out of 2·83% of carbonate in the fine earth, only 1·68% was less than 60-mesh fineness.

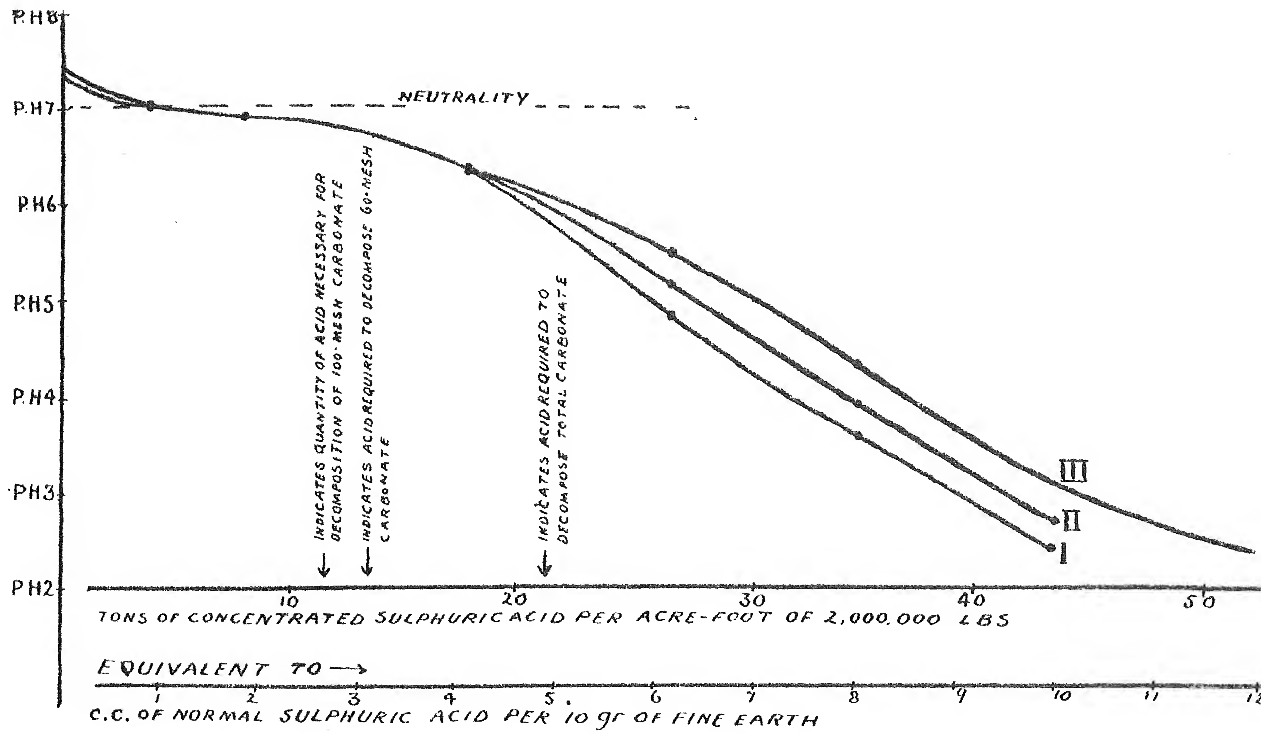


Figure 7.—Showing the acidity acquired by Soil C1—I. TWO weeks after addition of acid.
II. FOUR " " " " "
III. TEN " " " " "

Comparative acid-resisting properties of Calcareous and non-calcareous soils.

A series of observations on soils containing limestone and on acid soils which were free from this substance are collected for comparison in Figure 8 (page 228). All of the acidity readings in this case were taken one week after the soil had been treated with sulphuric acid as in experiment I. The results show that while the soils containing free limestone successfully resist the action of a very considerable amount of free acid, those which are devoid of limestone, on the other hand, undergo practically spontaneous increase in acidity on such treatment. In the results shown in Figure 9 (page 229) the same soils were allowed to interact with acid for fourteen days, after which they were each washed with one hundred times their weight of water before acidity readings were taken. The results thus obtained no doubt bear a closer approximation to an intensive acidifying treatment in the field.

Discussion.

While certain fertilizers, such as sulphate of ammonia or sulphate of potash undoubtedly exert an acidifying influence when applied to the soil, it is clear from the foregoing results that the extent of the acidification resulting from the use of these fertilizers must necessarily vary very considerably from soil to soil. It is obviously erroneous, therefore, to assume that because a fertilizer is known to have an acidifying influence, its use must result in the immediate production of an acid soil. The degree of acidification produced in any particular case is necessarily correlated with the reserve of basic material in the soil, so much so, that in calcareous soils the use of acidifying fertilizers may not necessarily give rise to any immediate acidification at all.

At the same time, regular and continuous use of acidifying manures must result in the *ultimate* acidification of all soils. From the immediate practical aspect, however, it seems reasonable to conclude that the use of sulphate of ammonia on soils containing finely divided limestone demands no supplementary lime applications until the stage is reached when the soil will have ceased to be calcareous. The neutralising influence of free limestone in the soil may readily be seen from the fact that 1% is equivalent to about nine tons of calcium carbonate per acre-foot of 2,000,000 lbs. This amount of limestone is capable of neutralising nearly the same weight of concentrated sulphuric acid.

Is free limestone necessary to high fertility?

If, in applying acidifying manures to calcareous soils we decide to dispense with supplementary liming, will any disadvantages to fertility arise from the depletion of free limestone from the soil? It is generally taken for granted that the presence of free limestone in the soil is essential if conditions of maximum fertility are to be attained. This belief, however, is questionable.

The carbonate content of the soil is often regarded as a criterion as to whether an application of lime should be given. Some authorities hold that

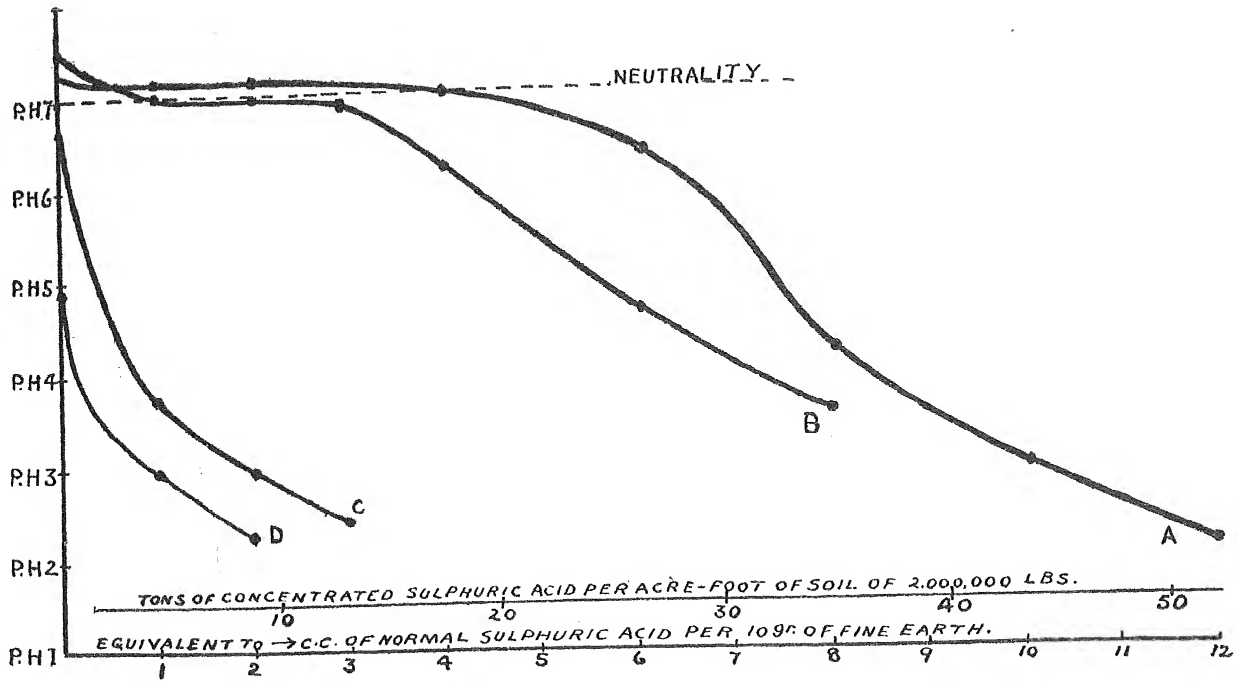


Figure 8.—Showing comparative acid-resisting properties of limestone and non-limestone soils.

A: Soil from plot A at Stormanstown which contains 3.92 per cent. of 1 m.m. carbonate.

B: Soil from plot C_1 at Stormanstown containing 2,83 per cent. of 1m.m. carbonate.

C: Very fertile granite soil from Borris, Co. Carlow, practically free from limestone.

D: Red Sandstone Soil, Co. Fermanagh. Free from limestone.

The above acidity readings were taken one week after simple treatment of the soils with acid.

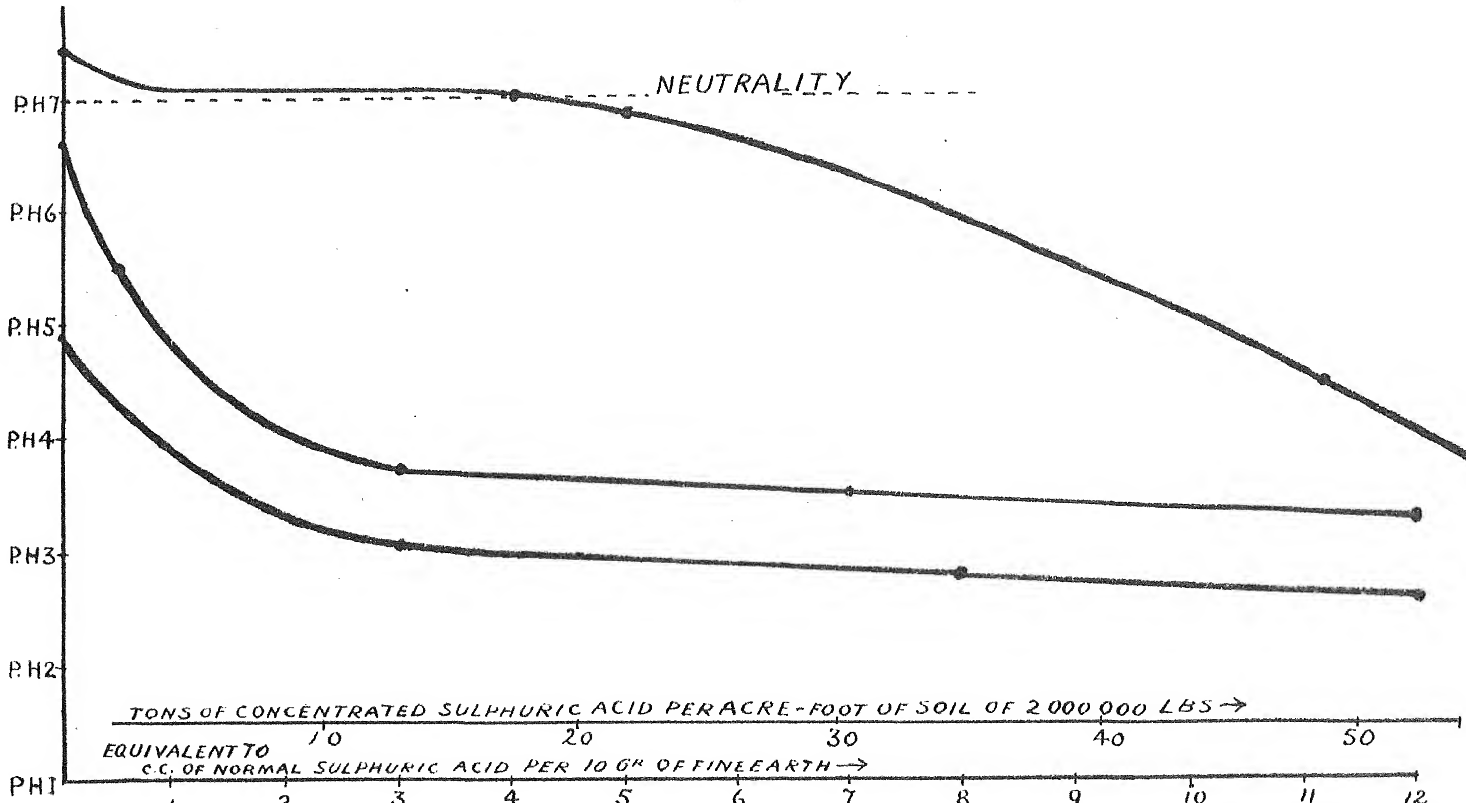


Figure 9.—Showing acidities of Soils A, C and D (Figure 8) after leaching with 100 parts of water fourteen days after acid treatment.

when the carbonate content of the soil has fallen below 1%, an application of lime will prove an advantage.

It is true that very many acid soils contain very little or no free limestone. If limestone be incorporated with an acid soil, the soil will decompose it, and this decomposition will continue until the soil is saturated and neutralised. If we assume that the limestone has been well ground and thoroughly incorporated with the soil, no undecomposed limestone should remain until more than sufficient has been added to effect complete neutralisation. If as much as 1% of free calcium carbonate in the soil is an advantage from an agricultural point of view, then we ought to continue to derive advantage when liming an acid soil by always adding at least nine tons of limestone per acre-foot in excess of the amount of lime which would primarily be necessary to effect complete neutralisation. Needless to say, no such result has ever been recorded in practice.

It is important to know to what extent it is admissable to sacrifice the reserve of carbonate already present in a soil. Will the dissolution of all free carbonate from the soil be of immediate injury to crops? There is considerable evidence which indicates that no such danger exists. In this respect the following observations made on some excellent soils are of particular interest.

Lime content of good beet soils.

Beet is a crop which is ordinarily regarded as having what may be termed a high lime-requirement. The writer has had an opportunity of examining three soil samples chosen because of the excellence of their respective beet crops. In each case the crop is described as "really excellent as regards uniformity, weight, sugar-content and shape of roots." The hydrogen-ion concentrations of these soils were pH 6·3, 5·9 and 7·15, respectively. The amount of 1 m.m. limestone present in two of these soils proved to be too small for measurement by the ordinary methods, while the third soil contained 0·48% $Ca\ CO_3$. These soils were taken from near Borris, and are mainly of granitic origin.

Limestone content of good pasture land.

Four soil samples were furnished me from excellent Meath pastures by Mr. P. Linehan, B.Agr.Sc., of the Plant Breeding Department of the University. The hydrogen-ion concentrations of these samples were pH 6·4, pH 6·0, pH 6·9 and pH 6·4. The respective calcium carbonate contents in the 1 m.m. fine earth were too small for measurement by ordinary methods in the case of the first two samples referred to, while in the case of the last two the values obtained were 0·64% and 0·16% respectively.

The striking feature about all of these results is the relative poverty in carbonate of all the soils examined. These soil samples were independently chosen for me because of their excellent cropping qualities. They are not part of a general survey.

That out of three soils chosen because of their having produced really excellent beet crops, two should prove to be practically free from limestone,

is of especial interest in view of the fact that beet is regarded as a big lime-feeder. Beet will very frequently fail to grow on very acid soils. A very acid soil will require the application of several tons of lime per acre in order to render it suitable for beet production. It is important to note that the amount of lime which must be applied to the soil in such cases is out of all proportion to the amount of this substance which the crop itself requires from the soil. An average beet-crop removes the equivalent of less than twenty pounds of burnt lime per acre.

Function of Free Limestone in the Soil.

It is of importance to all crops, and particularly to beet, that soil acidity be kept within reasonable limits. To so control acidity appears to be the prime function of calcium carbonate in the soil. The immediate effectiveness of soil carbonate depends on its state of division and uniformity of distribution. Excess of finely divided lime ensures neutrality or slight alkalinity. With the disappearance of free limestone from the soil acidification necessarily begins, but there is no apparent reason to believe that the disappearance of free limestone from the soil is attended by any immediate disadvantages to fertility. On the contrary, in so far as certain crops appear to grow best under slightly acid conditions, the disappearance of free carbonate from the soil may, from this point of view, prove an actual advantage.

Apart from these considerations an application of burnt lime to a soil which already contains free limestone may conceivably produce beneficial results through disinfectant action or by temporarily stimulating decompositions in the soil. A result of this nature, however, does not affect the general argument in regard to the influence of free limestone on the soil. It should likewise be realised that though a soil may readily become devoid of free limestone only an abnormal soil can be considered entirely devoid of calcium carbonate. *Calcium carbonate must necessarily persist in the soil solution as long as exchangeable calcium remains in the soil in presence of carbon dioxide.* Hence the evident importance of a liberal supply of exchangeable calcium in the soil, as has been shown by Robinson and Williams (14) and others.

Clay and Humus as Acid-resisting Factors in Soils.

When the supply of free limestone in the soil has become exhausted, any treatment resulting in the formation of free acid must then inevitably lead to soil acidification. But the rate at which acidification takes place will vary very considerably in different soils. In this connection there exists a striking difference in behaviour between two main types of soil constituents, the colloids and the non-colloids. The former group of substances, which includes clay and humus, is endowed with very considerable buffering power, and can consequently offer important resistance to acidification; the latter group, consisting mainly of silt and sand, can offer scarcely any resistance at all. The rate at which a soil will be liable to become acid, after its free carbonate has become exhausted, will therefore depend on the relative proportions of humus, clay and sand in its composition. In this respect, the physical or mechanical analysis of a soil is an index of its buffering power.

In general, it may be said that starting from neutrality, a clay or peaty soil will be liable to acquire a dangerous acidity much more slowly than a light sandy soil ; conversely, when a soil containing much clay or peat becomes acidified, it is much more formidable to neutralise again than is the case with sand.

In so far as a soil which is devoid of limestone can resist or delay acidification, to substantially the same extent will that soil subsequently resist the action of lime when it is desired to overcome acidity.

SUMMARY AND CONCLUSIONS.

In view of the increasing use of sulphate of ammonia as a fertilizer, particularly on pasture land, the capacity of the soil to resist the action of acidifying manures has been submitted to special study.

The general question of the influence of fertilizers on soil reaction has been reviewed. The available evidence indicates that of the fertilizers at present in common use, sulphate of ammonia is that which is most likely to acidify the soil.

A number of experimental pasture plots at Stormanstown on the University Farm have, during the past two years, been treated with relatively heavy dressings of sulphate of ammonia. No soil acidification, however, is yet apparent.

Laboratory experiments were carried out with a view to determining to what extent similar manurial treatment could be continued at Stormanstown without inducing an acid soil condition in the absence of supplementary lime applications. The results show that the soil of the control plot at Stormanstown ought to be capable of completely resisting the acidifying action of sulphate of ammonia, applied at the rate of 4 cwts. per annum, for more than sixty years.

The capacity of the soil at Stormanstown to remain in a neutral condition in spite of the action of acidifying fertilizers is shown to be intimately related to its carbonate content. Experiments carried out on carbonate-free soils show that in the absence of free limestone, acidification is practically spontaneous when acid is added to, or liberated in, the soil. It should be noted, however, that the rate at which acidification will take place in a carbonate-free soil is necessarily dependent on the clay and humus content.

In studying the influence of added acid on the Stormanstown soil the relative inactivity as a neutralising agent, of a considerable fraction of the calcium carbonate ordinarily included in soil analysis, is demonstrated. The active carbonate in the soil appears to correspond to that present in the 60-mesh soil fraction rather than to that present in the 1 m.m. fraction. In the Stormanstown samples, roughly one-half of the carbonate present in the 1 m.m. fraction is capable of passing the 60-mesh sieve. The coarser-grained particles of the 1 m.m. fine earth no doubt exert their influence in time, in which case the soil would really be capable of neutralising a considerably greater quantity of acid than that recorded in the present experiments. On the other hand, allowance should be made, in any calculation covering a considerable number of years, for loss of carbonate from the soil by leaching.

The quantity of carbonate lost from calcareous soils in this way may sometimes amount to as much as half a ton of $CaCO_3$ per acre per annum.

While rainfall causes an inevitable loss of limestone from calcareous soils it may at the same time be expected to moderate the action of an acidifying fertilizer in a non-calcareous soil. Toxic acidity would therefore appear to be more likely to arise from the use of acid fertilizers in a dry, than in a wet climate.

The question has been discussed as to whether the presence of a definite quantity of free limestone is necessary in the soil to maintain a condition of high fertility, or whether free limestone is to be regarded merely as a buffer substance ensuring soil neutrality. Observations are given on a number of soils of noted fertility and while some of these proved to be actually devoid of measurable quantities of free limestone, the others which were examined contained considerably less than that ordinarily regarded as essential to a fertile soil. It does not appear likely, therefore, that the depletion of free limestone from the soil through the use of acidifying fertilizers will, of itself, give rise to any immediate disadvantages.

The general conclusion suggested by the present investigation is that on soils containing free, finely-divided, limestone there exists no apparent necessity to supplement the use of acidifying fertilizers, such as sulphate of ammonia, with lime treatment. On non-calcareous soils the necessity for supplementary liming essentially depends on the degree of acidification already present in the soil.

ADDENDUM.

MECHANICAL ANALYSES OF SOILS USED IN THIS INVESTIGATION.

——	Composite sample from Stormanstown plots	Fermanagh Sandstone Loam
Moisture	5·70 per cent.	3·84 per cent.
Loss on ignition ...	6·31 ,, ,,	12·18 ,, ,,
Carbonates	3·52 ,, ,,	absent
Coarse sand ...	7·99 ,, ,,	18·37 ,, ,,
Fine sand	17·55 ,, ,,	28·75 ,, ,,
Silt	10·75 ,, ,,	11.00 ,, ,,
Fine silt	26·50 ,, ,,	14·75 ,, ,,
Clay	17·75 ,, ,,	10·25 ,, ,,
Loss in solution ...	2·60 ,, ,,	1·91 ,, ,,
	98·67 ,, ,,	101.05 ,, ,,

Carbonate Contents of Stormanstown Pasture Plots.

Plot	Surface 9″, $CaCO_3$%	Subsoil 9″, $CaCO_3$%
A	3·92	2·80
B	2·80	2·59
C	4·11	8·70
C¹	2·83	3·36
D	3·25	2·00
D¹	3·75	2·74

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VALIDITY OF THE COMMON TESTS FOR PURITY AS APPLIED TO IRISH WINTER-MADE BUTTER, 1927-28.

By P. S. Arup, M.Sc. Lond., F.I.C., A.C.G.I.

FOREWORD.

Experience has shown that, for one reason or another, some Irish butters produced in the winter months, when analysed according to the scientifically accepted methods, give results which, in the opinion of some analysts, are calculated to raise doubts as to the purity of the product, especially having regard to the standard suggested by the Departmental Committee on Butter Regulations. One of the consequences of this has been that prosecutions have, from time to time, been instituted against vendors of Irish butter on the ground that the butter was not genuine, and these proceedings have had an injurious effect on the reputation of the butter made in this country.

With a view to protecting the interests of the Irish butter industry, the Department of Agriculture determined in 1908 and 1909 to undertake a series of investigations with the object of testing the reliability of the analytical standards of purity then in use. The results of these investigations were published in the Department's Journal Vol. X. page 438. The effect of those results was to show that at certain seasons of the year samples drawn from what were known to be perfectly genuine Irish butters gave analytical figures akin to those which had already aroused suspicion in the minds of Public Analysts in Great Britain, and had sometimes formed the basis for prosecutions. These first investigations, although satisfactory so far as they went, were not considered exhaustive enough in view of the importance of the problem, and hence it was deemed advisable to undertake further research work, which was, accordingly, carried out by the Department in 1923-4. The results were published in the Scientific Proceedings of the Royal Dublin Society, 1925, Vol. XVIII (N.S.). Sufficient evidence was then believed to have been accumulated to show that the analytical data ordinarily employed in determining the genuineness or otherwise of a sample of butter were not conclusive in the case of some Irish butters made in the winter season, and the work was then suspended.

Further complaints and prosecutions, however, arose in later years. While in some of these cases the proceedings were discontinued upon the production in evidence of the results ascertained by the investigations already referred to, it was considered well to re-commence the investigations on a wider scale so that no effort should be wanting to preserve the good name of Irish butter. Accordingly, a further series of analyses was carried out during 1927-8 in which samples of cream or butter obtained from creameries in both the older and newer districts and from the Department's own farms were examined. The results

of these analyses are set forth in the following article, a summary of which was read in the form of a paper by Mr. P. S. Arup, M.Sc., Lond., F.I.C., A.C.G.I., Analyst under the Dairy Produce Act, at the meeting of the Society of Public Analysts on the 2nd October, 1929.

The purpose for which these investigations were undertaken renders it necessary to print the results at each place in full detail in order that the minimum figures, in every case, may be made available, as averages only are not regarded as of sufficient value for the purposes of defence in the event of prosecution. These detailed results will be brought to the notice of the Public Analysts of Great Britain in the hope that the latter may find the data thus provided of use when considering the purity, or otherwise, of any butter samples submitted to them for analysis. In the absence of such detailed evidence it is quite possible that an individual creamery or dairy farmer might find itself or himself unjustly prosecuted and penalised, and that, incidentally, a totally undeserved reflection might be cast upon the genuineness of Irish butter generally.

* * * * * *

Previous to the work of Brownlee, referred to above, the fact that genuine Irish Winter Butter gives abnormal results on analysis had been established by Handby Ball in 1907 (Analyst 1907, 32, 202). As is well known, calving in Ireland takes place almost exclusively during one season of the year, February to May, and abnormally low Reichert Meissl values are observed at the end of the lactation period. It had been pointed out on several occasions in the Journal of the Department of Agriculture and Technical Instruction, both by Mr. G. Brownlee, B.Sc., F.I.C. and by Mr. A. Poole Wilson, that under these conditions the assumption of the minimum standard of 24 for the Reichert Meissl value was likely to arouse suspicion in regard to the purity of perfectly genuine butter. In the investigations described here it was decided to determine, at the same time, the Polenske and Kirschner values and refractive indices of all the samples taken, and in particular to investigate the validity of the Avé Lallemant test as a criterion of genuineness for butter with abnormally low Reichert Meissl values. It is claimed in a number of standard text books that the Avé Lallemant value may be so used, but Brownlee (loc. cit) has thrown considerable doubt on thie claim.

The samples of cream or butter required for the investigation were taken at 32 creameries and at the dairies on the farms attached to the Agricultural Stations at Ballyhaise and Clonakilty by Inspectors of the Department of Agriculture in such a way that the genuineness and representative character of the samples was assured. Sampling was done during the period from October 27th, 1927, to March 31st, 1928, as nearly as possible at fortnightly intervals. A total of 310 samples were received.

Most of the samples were taken as cream and, except in the case of those from the Agricultural Stations, each sample represented the mixed milk of a large number of herds. The figures obtained are, therefore, likely to show

less variation from the normal than would have been the case if single herds had been sampled. In this respect the results obtained are comparable with those obtained by Brownlee (loc. cit.).

Separation of Fat.—It was found during the course of the investigation that the fat could readily be separated from the cream samples by first freezing them, whereby the cream emulsion was broken, and then warming to about 60°. The fat then collected in a clear layer which could easily be dealt with. Where the fat globules in the cream were exceptionally small, as sometimes occurs in cream from milk produced towards the end of the lactation period, it was necessary to repeat the freezing and heating of certain samples in order to obtain a good separation.

For the purpose of Table A p. 242 the fortnightly average Reichert Meissl, Polenske and Kirschner values and the refractive indeces for all samples taken are shown for the period 27th October, 1927 to 31st March, 1928, and in addition the maximum and minimum values, respectively, recorded fortnightly during that period.

Full particulars of samples having a Reichert Meissl value above 24, which were also tested by the Avé Lallemant method, are given in Table B, and full particulars of all samples having a Reichert Meissl value below 24 are given in Table C. pp. 244 and 245.

The Average and maximum and minimum values recorded for the individual creameries are given in Table D.

Reichert Meissl Figures.—The following table shows particulars of the number of samples giving Reichert Meissl values under 24 :—

Reichert Meissl.	No. of Samples	Percentage	Dates of Samples.
Below 20	Nil	Nil	
20—20·9 inclusive ...	3	0·9	14/12/27 to 23/12/27
21—21·9 inclusive ...	8	2·6	23/11/27 to 16/ 1/28
22—22·9 inclusive ...	16	5·2	23/11/27 to 21/ 1/28
23—23·9 inclusive ...	23	7·4	31/10/27 to 31/ 1/28
Total under 24 ...	50	16·1	31/10/27 to 31/ 1/28

The last sample with a Reichert Meissl value under 25 was taken on February 14th and the last sample with a R. M. value under 26 was taken on March 6th. The average R. M. value dropped below 24 during a period including approximately the last nine days of November and the first three weeks of December. All the samples giving Reichert Meissl values below 24 occurred from October

31st to January 31st inclusive. During this period 184 samples were taken. the proportion of these showing a Reichert Meissl value below 24 being 27·2 per cent.

Brownlee (loc. cit.) found in 1924-25, that all samples with Reichert Meissl below 24 occurred from October 26th to February 6th inclusive, and that of the 75 samples taken during this period 81 per cent. were below the standard of 24. Of the total number, 5 samples were below 20 as against none in the present—1927-28—series, and 20 samples were below 21 as against 3 in 1927-28. The twelve creameries sampled in 1924-5 were all included in the present series, and the striking difference between the two sets of figures points to an appreciable improvement in Irish dairy farming due to (1) a tendency to extend the calving period, and (2) the better treatment and feeding of cows during the winter.

The samples from the Department's Agricultural Stations at Ballyhaise and Clonakilty included in the present series, 20 in all, call for special mention, for in no case did they give Reichert Meissl figures below 26. This may be explained by the fact that calving on these farms is not confined to one season of the year, and that the conditions as regards feeding and housing are better than those which obtain on farms generally. Similar effects are noted with regard to the Polenske values below.

Polenske Value.—The maximum value recorded was 3·20 in connection with a Reichert Meissl value of 31·4 and the minimum, 1·15 in connection with a Reichert Meissl value of 22·2.

The following table shows the average, maximum, and minimum Polenske values obtained with progessive Reichert Meissl values :—

Number of Samples.	R.M. from —0·5 to +0·4.	Polenske.			Variation between Max. & Min.
		Average.	Maximum.	Minimum.	
15	22	1·50	1·70	1·15	0·55
22	23	1·60	1·80	1·35	0·45
43	24	1·65	2·00	1·40	0·60
56	25	1·70	2·25	1·35	0·90
35	26	1·90	2·40	1·45	0·95
26	27	1·95	2·85	1·55	1·30
22	28	2·05	3·05	1·60	1·45
15	29	2·20	2·85	1·75	1·10
26	30	2·10	2·85	1·65	1·25
30	31	2·25	3·20	1·60	1·60

For Reichert Meissl values of 22-26 inclusive, the average Polenske values agree very closely with those given by Bolton in his " Oils, Fats and Fatty Foods." For increasing Reichert Meissl values above 26, the average Polenske values commence to fall below Bolton's figures, being 0·95 less at a Reichert Meissl value of 31.

All the creameries sampled, the Agricultural Stations at Ballyhaise and

Clonakilty excluded, tended to produce butters showing Polenske values below the normal; this is reflected by the somewhat large differences between maximum and minimum values in the above table for Reichert Meissl values of 26 and over: all the maximum Polenske values recorded, however, fall within 0·5 of the standards given by Bolton, thus confirming his criterion indicating freedom from adulteration with cocoanut or palmnut oils. In contradistinction to the creameries sampled, 10 samples from Ballyhaise Agricultural Station showed averages:—Reichert Meissl 28·3, Polenske 2·5; 10 samples from Clonakilty Agricultural Station showed averages:—Reichert Meissl 29·0, Polenske 2·75; *i.e.*, normal Polenske values, probably due to reasons similar to those already discussed in connection with Reichert Meissl values above.

Kirschner Value.—This was determined by the standard method, using aluminium wire in the distillation. The minimum value recorded was 14·6 in connection with a Reichert Meissl value of 20·4, and the maximum was 24·1 in connection with a Reichert Meissl value of 32·7. The average Kirschner value of all the samples was 73·4 per cent. of the average Reichert Meissl value. In the case of individual samples, this percentage varied from 68·0 to 79·6, but showed no co-ordination with variations in the Reichert Meissl value or other factors.

The relationship between Kirschner and Polenske values is shown in the following table:—

Number of Samples.	K. value —0·5 to +0·4.	Polenske Value.			Variation between Max. & Min.
		Average.	Maximum.	Minimum.	
30	17	1·55	1·85	1·15	0·70
69	18	1·70	2·40	1·35	1·05
67	19	1·85	2·95	1·45	1·50
27	20	1·95	3·05	1·60	1·45
22	21	2·15	2·80	1·55	1·25
39	22	2·15	2·85	1·60	1·25
25	23	2·20	3·00	1·65	1·35

The agreement with figures published by Bolton and Revis and Richmond is not so good here as in the case of the relations between the Reichert Meissl and Polenske values, and in several cases the maximum Polenske values are too high to fit in with the criterion used for determining the presence of cocoanut oil or palmnut oil.

Avé Lallemant Value.—It was found that 22 samples with Reichert Meissl values varying from 20·4 to 25·5 showed Avé Lallemant values varying from +14·1 to —3·5 only one sample giving a negative value. Two samples having Reichert Meissl values of 26·7 and 31·4 showed Avé Lallemant values of —11.1 and —13·3 respectively. Brownlee (loc. cit.) found values varying from —25·0 to +10·4, 20 samples out of a total of 112 giving positive results.

The conclusion of Brownlee that the Avé Lallemant value cannot be taken

as a criterion for distinguishing between genuine butters having low Reichert Meissl values on the one hand, and adulterated butters of higher Reichert Meissl values on the other, is confirmed here. It would appear that butters with low Reichert Meissl values had not been sufficiently investigated in this connection before the matter was taken up by Brownlee, and that the Avé Lallemant value like most of the other commonly determined figures, merely tends to serve as a confirmation of the Reichert Meissl value.

Saponification Value.—In the case of 24 samples this value varied from 219·4 to 235·0, thus confirming the usually accepted limits for pure butter.

In Tables B & C, the figure obtained by adding 200 to the R. M. figure and subtracting the saponification value, has been given. According to Juckenack and Pasternack, this figure should lie between + 4 and − 4 in the case of genuine butter. It will be noted that these limits are overstepped on the negative side in two cases, so that while this criterion is not infallible, it possesses a greater degree of reliability than the Avé Lallemant value.

[TABLES

TABLE A.

SHOWING FORTNIGHTLY AVERAGE AND MAXIMUM AND MINIMUM REICHERT MEISSL, POLENSKE AND KIRSCHNER VALUES AND REFRACTIVE INDICES FOR ALL SAMPLES.

Period	No. of Samples	Reichert Meissl	Polenske	Kirschner	Refractive Index	Maximum				Minimum			
						R.M.	Pol.	K.	R.I.	R.M.	Pol.	K.	R.I.
27/10/27—15/11/27 ...	37	24·96	1·71	18·17	44·71	26·8	2·40	19·5	46·0	23·0	1·35	17·2	42·3
16/11/27—30/11/27 ...	34	24·23	1·74	17·65	44·43	28·2	2·70	21·7	45·2	21·9	1·40	15·9	41·8
1/12/27—15/12/27 ...	24	23·80	1·68	17·77	44·25	29·7	2·85	20·9	45·4	20·8	1·15	15·7	41·5
16/12/27—31/12/27 ...	22	23·81	1·75	17·76	43·65	28·8	2·45	21·7	45·0	20·4	1·35	14·6	41·9
1/ 1/28—15/ 1/28 ...	24	24·65	1·88	18·20	43·79	28·9	2·95	20·6	44·7	21·6	1·60	15·9	42·0
16/ 1/28—31/ 1/28 ...	40	25·77	1·80	19·06	44·21	29·4	2·85	23·0	45·9	22·7	1·45	16·8	41·7
1/ 2/28—15/ 2/28 ...	32	26·98	1·89	19·81	44·08	31·9	3·20	22·0	45·5	24·4	1·60	17·2	42·9
16/ 2/28—29/ 2/28 ...	30	28·55	2·10	21·18	44·07	31·6	3·05	24·3	45·3	25·2	1·55	17·8	43·5
1/ 3/28—15/ 3/28 ...	35	29·52	2·03	21·60	44·06	32·9	2·85	23·6	45.5	25·1	1·40	18·6	43·2
16/ 3/28—31/ 3/28 ...	32	30·11	2·12	21·71	44·03	32·7	3·00	23·8	45·2	26·7	1·45	18·3	43·2

TABLE B.

PARTICULARS OF SAMPLES WITH A REICHERT MEISSL VALUE OVER 24.

No.	Creamery.	Date.	Reichert Meissl.	Polenske.	Kirschner.	K. as per cent. of R. M.	Refractive Index.	Saponification value.	Avé Lallement.	Reichert Meissl figure +200 minus Saponification value.
95	Ballyduag	14/12/27	24·8	1·65	19·2	77·5	44·1	225·5	+ 8·7	— 0·7
114	Listowel	24/12/27	24·9	1·75	19·1	76·6	42·8	225·0	+11·0	— 0·1
110	Coachford	30/12/27	24·1	1·90	18·0	75·0	44·4	225·0	+ 7·6	— 0·9
117	Clones	23/12/27	25·3	1·95	19·0	75·1	44·0	225·5	+ 7·5	— 0·2
124	Clones	2/ 1/28	25·5	2·00	19·0	74·5	44·2	226·1	+ 7·7	— 0·6
128	Clonakilty Agricultural Stn. ...	4/ 1/28	26·7	2·95	18·9	70·7	42·0	235·0	—11·1	— 8·3
308	Ballyduag	28/ 3/28	31·4	2·55	22·4	71·4	43·7	233·4	—13·3	— 2·0

TABLE

PARTICULARS OF SAMPLES WITH A

No.	Creamery.		Date.		Reichert Meissl.
115	Kilteely	Total 3 R. M. 20.0—20.9 incl.	23/12/27	14/12/27 to 23/12/27	20·4
116	Oola		23/12/27		20·6
97	Castlecor		14/12/27		20·8
58	Castlecor	Total 8 R.M. 21.0—21.9 incl.	23/11/27	23/11/27 to 16/1/28	21·9
81	Oola		5/12/27		21·9
100	Drombanna		14/12/27		21·6
104	Herbertstown		19/12/27		21·2
107	Newmarket		21/12/27		21·6
134	Solohead		7/1/28		21.7
137	Oola		7/1/28		21·6
143	Dromkeen Sep., Stn.		16/1/28		21·7
55	Centenary	Total 16 R. M. 22.0—22.9 incl.	23/11/27	23/11/27 to 21/1/28	22·6
66	Glenmore		28/11/27		22·9
73	Dromkeen		30/11/27		22·1
74	Kilteely		30/11/27		22·5
120	Ardagh		31/12/27		22·9
80	Newmarket		5/12/27		22·6
82	Kilteely		7/12/27		22·0
85	Glenmore		9/12/27		22·6
90	Dromkeen		12/12/27		22·2
92	Kantoher		14/12/27		22·4
98	Tournafulla		16/12/27		22·8
109	Killeshandra		22/12/27		22·3
119	Ardagh		31/12/27		22·9
127	Castlecor		4/1/28		22·4
144	Kilteely		16/1/28		22·3
166	Oola		21/1/28		22·7
9	Glenmore	Total 23 R. M. 23.0—23.9 incl.	31/10/27		23·0
21	Drombanna		3/11/27		23·2
24	Clonakilty		4/11/27		23·1
68	Ardagh		28/11/27		23·4
69	Oola		28/11/27		23·1
71	Kantoher		29/11/27		23·5
72	Tournafulla		30/11/27		23·2
77	Drombanna		2/12/27		23·2
84	Lough Eagish		7/12/27		23·7
91	Ardagh		12/12/27		23·6
93	Coachford		14/12/27		23·1
111	Lixnaw		23/12/27		23·8
112	Riverstown		23/12/27		23·8
122	Buttevant		29/12/27		23·8
123	Kantoher		2/1/28		23·5
129	Killeshandra		5/1/28		23·8
142	Ardagh		14/1/28		23·4
159	Solohead		19/1/28		23·4
164	Herbertstown		21/1/28		23·3
169	Newmarket		23/1/28		23·9
176	Kilteely		26/1/28		23·1
185	Solohead		31/1/28		23·1
188	Oola		31/1/28		23·9

C.

REICHERT MEISSL VALUE UNDER 24.

Polenske.	Kirschner.	K. as per cent. of R. M.	Refractive Index.	Avé Lallemant.	R. M. Figure +200 minus Saponification figure.	Saponification value.
1·70	14·6	71·6	45·0	+11·3	+ 1·0	219·4
1·86	15·1	73·3	45·0	+ 6·5	+ 0·6	220·0
1·50	16·0	77·0	44·8	+ 9·3	+ ·7	220·1
1·45	16·5	78·6	43·2	+14·0	+ 1·0	220·9
1·50	15·9	72·2	44·5	—	—	—
1·35	15·7	72·7	44·5	+11·9	+ 0·7	220·9
1·45	16·5	77·8	43·8	+14.0	+ 1·5	219·7
1·40	16·3	75·4	43·9	+14·1	— 1·3	222·9
1·69	15·9	73·3	43·9	+13·6	+ 0.8	220·9
1·60	16·4	75·9	44·2	+ 0·6	— 3·3	225·0
1·70	16·3	75·1	45·0	+ 4·3	—	225·3
1·65	15·9	70·0	44·1	+ 5·3	— 5·1	227·7
1·40	17·6	76·8	45·0	—		—
1·50	16·1	72·8	44·7	—		—
1·45	16·0	71·1	45·0	—		—
1·80	17·5	76·4	43·3			
1·40	17·0	73·2	44·5	—		—
1·70	16·1	73·2	45·2	—		—
1·35	16·5	73·0	45·5	—		—
1·15	16·8	75·7	45·4	—		—
1·60	16·8	75·0	44·4			
1·70	17·3	76·0	43·8	+ 8.1	+ 0.1	222.7
1·50	17.1	76·7	44·6	— 3.5	— 2.7	225.0
1·80	17.5	76·4	43·3	+ 6·0	— 2·1	225·0
1·60	17·1	76·2	44·7			
1·55	16·2	72·7	44·1			
1·50	17·3	76·2	43·8			
1·45	17·5	76·0	45·5			
1·65	18·3	78·9	44·9			
1·45	17·2	74·5	45·0			
1·60	17·5	74·7	44·7			
1·75	18·0	72·2	44·5			
1·60	17·3	73·5	44·7			
1·70	16·7	72·1	44·4			
1·65	17·7	76·4	45·0			
1·45	17·4	73·3	44·5			
1·75	18·0	76·2	45·2			
1·80	18·0	77·9	44·4	+11.7	+ 2.1	221.0
1·90	18·5	77·7	44·0	+ 8.4	— 0.6	224.4
1·85	18·3	76·9	43·3	+ 9.0	— 0.6	224.4
1·80	18·8	79·0	43·3			
1·85	18·1	77·0	43·8			
1·85	18·2	76·4	43·5			
1·80	16·6	70·4	43·5			
1·70	16·8	71·7	43·7			
1·60	17·5	75·0	44·4			
1·70	18·5	77·4	44·3			
1·65	17·0	73·5	45·3			
1·40	16·8	72·4	45·9			
1·60	17·8	74·5	44·9			

SHOWING THE AVERAGE AND MAXIMUM AND MINIMUM

CREAMERY.	REICHERT MEISSL.			POL-
	Average	Max.	Min.	Average
Agricultural Station, Ballyhaise ...	28·29	30·6	26·0	2·50
Agricultural Station, Clonakilty ...	28·96	31·5	26.7	2·75
Ardagh	26·0	30·5	22·9	1·79
Ballyduag	28·04	31·4	24·8	2·08
Borrisoleigh	26·61	31·7	24·0	1·97
Buttevant	27·46	31·7	23·8	1·90
Castlecor	26·16	31·1	20·8	1·82
Collooney	27·46	26·7	24·0	1·72
Centenary	27·83	31·0	22·6	2·06
Clonakilty (Hill)	27·86	30·8	23·1	2·02
Clones	26·55	28·3	25·3	1·95
Coachford	26·98	32·5	23·1	1·90
Drombanna	25·25	30·8	21·6	1·71
Dromkeen	25·50	30·5	21·7	1·61
Effin	26·98	31·1	24·0	1·87
Firies	27·74	31·9	24·0	1·93
Glenmore	27·05	32·9	22·6	1·86
Herbertstown	25·70	30·1	21·2	1·76
Kantoher	26·13	33·3	23·5	1·86
Killeshandra	26·08	31·3	22·3	1·81
Kilteely	24·23	29·8	20·4	1·65
Knocklong	27·26	28·8	24·6	1·83
Listowel	27·12	31·4	24·1	1·84
Lixnaw	27·34	32·7	23·8	1·90
Lough Eagish	24·94	27·1	23·5	1·78
Mitchelstown	27·27	31·4	23·0	1·90
Co. Monaghan	24·71	25·3	24·2	1·63
Newmarket	26·12	30·5	21·6	1·81
Oola	24·36	30·5	20·6	1·73
Riverstown	25·34	28·2	23·8	1·75
Solohead	25·22	29·8	21·7	1·73
Tournafulla	25·51	29·8	22.8	1·76

VALUES RECORDED FOR INDIVIDUAL CREAMERIES.

ENSKE.		KIRSCHNER.			REFRACTIVE INDEX. ZEISS° AT 40°C.		
Max.	Min.	Average	Max.	Min.	Average	Max.	Min.
3·10	1·95	20·53	22·0	18·9	42·86	44·4	41·8
3·20	1·85	20·81	22·9	18·9	42·62	43·7	41·5
2·00	1·40	19·07	22·4	17·4	44·70	45·4	43·3
2·55	1·65	19·80	23·0	18·9	44·08	44·9	43·5
2·45	1·55	19·79	22·2	17·9	44·25	44·9	43·4
2·10	1·65	20·05	23·1	18·2	44·51	45·0	43·3
2·45	1·45	19·43	23·3	16·0	44·21	45·2	43·2
1·90	1·55	18·77	20·4	17·7	44·50	45·3	43·9
2·40	1·55	20·31	23·0	15·9	44·29	45·8	43·5
2·45	1·45	20·23	22·9	17·2	44·45	45·0	43·9
2·20	1·75	19·08	21·0	18·5	44·62	45·2	43·4
2·30	1·60	19·46	22·8	17·1	44·75	46·0	44·2
1·95	1·35	18·94	23·5	15·7	44·80	45·8	43·9
1·90	1·15	18·50	22·2	16·1	44·95	45·9	44·0
2·20	1·60	19·69	22·8	17·5	44·61	45·2	43·9
2·35	1·45	20·25	23·7	17·9	44·07	44·7	43·5
2·45	1·40	19·59	23·3	16·5	44·60	45·5	43·7
2·10	1·35	19·44	22·9	16·5	44·82	45·8	43·8
2·50	1·60	19·04	23·6	16·8	44·34	45·2	43·7
2·05	1·50	18·44	23·8	17·1	44·36	45·2	43·8
2·00	1·45	18·05	22·9	14·6	44·87	45·6	43·0
2·00	1·60	20·80	22·3	18·3	44·91	45·3	44·5
2·30	1·55	19·76	22·9	17·7	44·13	45·1	43·6
2·60	1·50	20·50	24·1	17·3	44·21	45·2	43·5
2·20	1·40	18·13	18·9	17·4	44·58	45·2	43·7
2·30	1·35	19·73	22·8	17·0	44·28	45·2	43·2
1·85	1·45	18·35	19·0	17·2	44·78	45·9	42·7
2·30	1·40	19·35	21·8	16·3	44·36	44·9	43·9
1·95	1·50	18·32	22·9	15·1	44·66	45·1	44·2
2·15	1·55	18·61	20·8	17·2	44·59	45·2	43·3
2·10	1·55	18·73	22·4	15·9	44·43	45·9	43·7
2·00	1·45	19·24	22.6	16·7	44·33	45·0	43·6

DETAILS OF RESULTS OF ANALYSIS OF SAMPLES FORM THE AGRICULTURAL STATIONS AND FROM EACH CREAMERY.

Agricultural Station, Ballyhaise.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
10/11/27 ...	26·0	2·30	19·5	75·0	42·3
25/11/27 ...	27·5	2·70	21·0	76·3	41·8
9/12/27 ...	29·7	2·80	20·9	70·3	42·1
22/12/27 ...	28·8	2·45	21·7	75·4	43·4
23/12/27 ...	26·5	1·95	18·8	71·0	41·9
7/ 1/28 ...	28·9	2·75	20·6	71·3	42·3
31/ 1/28 ...	29·2	2·35	22·0	75·3	43·0
17/ 2/28 ...	28·4	3·05	20·0	71·8	43·5
6/ 3/28 ...	30·6	2·20	21·3	69·6	43·9
29/ 3/28 ...	29·4	2·45	20·6	70·1	44·4
Average ...	28·29	2·50	20·53		42·86

Agricultural Station, Clonakilty.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
11/11/27 ...	26·8	2·40	19·0	70·9	42·3
25/11/27 ...	28·2	2·70	21·7	77·0	43·3
9/12/27 ...	27·4	2·85	19·2	70·1	41·5
4/ 1/28 ...	26·7	2·85	18·9	70·7	42·0
17/ 1/28 ...	27·5	1·85	19·6	71·3	41·7
31/ 1/28 ...	29·0	2·85	21·0	72·4	42·5
14/ 2/28 ...	31·4	3·20	22·0	70·1	42·8
28/ 2/28 ...	29·9	2·85	22·3	74·5	43·7
16/ 3/28 ...	31·2	2·85	22·5	72·1	43·2
27/ 3/28 ...	31·5	3·00	22·9	72·5	43·2
Average ...	28·96	2·75	20·81		42·62

Ardagh Creamery

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
3/11/27 ...	24·2	1·40	17·4	71·9	45·4
16/11/27 ...	24·6	1·85	17·4	70·7	44·4
28/11/27 ...	23·4	1·60	17·5	74·7	44·7
12/12/27 ...	23·6	1·75	18·0	76·2	45·2
31/12/27 ...	22·9	1·80	17·5	76·4	43·3
14/ 1/28 ...	23·4	1·80	16·6	70·4	43·5
28/ 1/28 ...	27·7	1·60	20·0	72·1	45·3
6/ 2/28 ...	27·0	2·00	20·4	75·5	45·2
25/ 2/28 ...	29·3	2·00	20·8	71·0	44·7
7/ 3/28 ...	29·5	1·95	21·8	74·0	44·8
20/ 3/28 ...	30·5	2·00	22·4	73·4	45·2
Average ...	26·0	1·79	19·07		44·70

BALLYDUAG CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C
27/10/27 ...	26·3	1·80	18·9	71·8	44·9
9/11/27 ...	25·7	1·95	18·9	73·5	44·1
23/11/27 ...	25·7	1·95	19·0	73·9	44·7
14/12/27 ...	24·8	1·65	19·2	77·5	44·1
31/12/27 ...	26·6	2·15	19·9	74·8	43·4
17/1/28 ...	28·6	2·35	20·4	71·3	43·5
3/2/28 ...	29·7	1·90	20·8	70·0	44·4
17/2/28 ...	29·4	2·10	21·6	73·4	44·3
29/2/28 ...	31·4	2·45	23·0	73·2	43·9
14/3/28 ...	30·0	2·10	21·5	73·7	43·9
28/3/28 ...	31·4	2·55	22·4	71·4	43·7
Average ...	28·04	2·08	19·8		44·08

BORRISOLEIGH CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
29/10/27 ...	26·3	2·20	18·4	70·0	44·9
11/11/27 ...	24·9	1·55	18·4	73·8	43·6
25/11/27 ...	24·7	1·70	18·6	75·4	44·4
17/12/27 ...	24·0	1·90	17·9	74·5	43·4
7/1/28 ...	24·3	1·80	18·5	76·0	44·2
17/1/28 ...	26·1	1·95	18·6	71·3	43·6
31/1/28 ...	27·5	1·85	20·0	72·7	44·9
18/2/28 ...	27·2	1·80	19·1	70·3	44·9
28/2/28 ...	28·9	2·45	22·0	78·7	44·4
14/3/28 ...	29·8	2·30	21·9	73·4	44·4
28/3/28 ...	31·7	2·25	22·2	70·0	44·0
Average ...	26·61	1·97	19·79		44·25

BUTTEVANT CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
27/10/27 ...	25·4	1·65	18·2	71·5	44·9
29/12/27 ...	23·8	1·80	18·8	79·0	43·3
14/1/28 ...	24·8	2·05	18·1	72·9	43·7
26/1/28 ...	26·4	1·85	20·1	76·0	45·2
9/2/28 ...	27·3	1·80	19·0	69·5	45·2
25/2/28 ...	30·4	2·10	22·0	72·4	44·4
7/3/28 ...	29·9	1·85	21·1	70·3	45·0
23/3/28 ...	31·7	2·10	23·1	72·8	44·4
Average ...	27·46	1·9	20·05		44·51

CASTLECOR CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
23/11/27 ...	21·9	1·45	16·5	78·6	43·2
14/12/27 ...	20·8	1·50	16·0	77·0	44·8
4/ 1/28 ...	22·4	1·60	17·1	76·2	44·7
17/ 1/28 ...	24·8	1·75	19·0	76·7	44·0
4/ 2/28 ...	25·7	1·90	18·2	70·8	44·4
15/ 2/28 ...	27·2	1·85	20·5	75·3	45·2
29/ 2/28 ...	31·0	1·85	22·5	72·6	44·2
14/ 3/28 ...	30·6	2·05	21·8	71·3	43·7
29/ 3/28 ...	31·1	2·45	23·3	74·8	43·7
Average ...	26·16	1·82	19·43		44·21

COLLOONEY CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
2/11/27 ...	25·4	1·65	18·7	73·6	44·4
16/11/27 ...	24·7	1·70	17·7	71·6	43·9
28/11/27 ...	25·0	1·70	18·0	72·0	44·0
13/12/27 ...	24·0	1·55	17·8	74·2	44·0
24/ 1/28 ...	24·8	1·65	19·1	77·0	44·3
7/ 2/28 ...	26·3	1·85	18·4	70·0	45·2
21/ 2/28 ...	25·2	1·90	18·8	74·5	45·3
6/ 3/28 ...	26·5	1·80	20·4	77·0	45·0
20/ 3/28 ...	26·7	1·75	18·9	70·7	44·4
Average ...	25·40	1·72	18·77		44·50

CENTENARY CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
27/10/27 ...	26·4	2·20	18·5	70·0	45·8
7/11/27 ...	25·0	1·55	19·2	76·8	44·9
23/11/27 ...	22·6	1·65	15·9	70·0	44·1
14/12/27 ...	24·8	1·80	18·6	75·0	43·6
7/ 1/28 ...	27·6	2·40	19·8	71·7	43·5
16/ 1/28 ...	27·2	2·05	19·1	70·3	43·7
30/ 1/28 ...	29·4	2·00	23·0	78·2	44·4
18/ 2/28 ...	30·4	2·35	23·0	75·6	44·0
1/ 3/28 ...	30·5	2·15	21·8	71·5	44·4
12/ 3/28 ...	30·5	2·40	21·9	71·8	44·4
28/ 3/28 ...	31·0	2·20	21·8	70·3	44·4
Average ...	27·83	2·06	20·31		44·29

CLONAKILTY CREAMERY (HILL).

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
4/11/27 ...	23·1	1·45	17·2	74·5	45·0
20/12/27 ...	24·4	1·70	17·2	70·5	43·9
16/ 1/28 ...	28·4	2·15	19·9	70·2	44·0
30/ 1/28 ...	25·2	1·80	18·9	75·0	44·4
13/ 2/28 ...	29·9	2·00	21·7	72·5	44·4
26/ 2/28 ...	30.8	2·40	22·4	72·7	44·4
12/ 3/28 ...	30·3	2·45	22·9	75·5	44·3
26/ 3/28 ...	30·8	2·20	22·0	71·5	45·2
Average ...	27·86	2·02	20·23		44·45

DROMBANA CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
2/11/27 ...	24·8	1·65	17·8	71·7	45·8
3/11/27 ...	23·2	1·65	18·3	78·9	44·9
14/11/27 ...	24·0	1·65	17·6	73·3	44·2
2/12/27 ...	23·2	1·65	17·7	76·4	45·0
14/12/27 ...	21·6	1·35	15·7	72·7	44·5
21/ 1/28 ...	24·6	1·85	18·4	74·8	43·9
30/ 1/28 ...	26·5	1·85	19·4	73·2	45·3
17/ 2/28 ...	25·3	1·80	19·0	75·1	45·1
5/ 3/28 ...	29·5	1·70	22·0	74·6	45·2
21/ 3/28 ...	30·8	1·95	23·5	76·3	44·1
Average ...	25·25	1·71	18·94		44·80

DROMKEEN SEPARATING STATION.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
31/10/27 ...	25·0	1·50	17·9	71·5	45·9
17/11/27 ...	24·1	1·65	18·0	74·7	44·8
30/11/27 ...	22·1	1·50	16·1	72·8	44·7
12/12/27 ...	22·2	1·15	16·8	75·7	45·4
16/ 1/28 ...	21·7	1·70	16·3	75·1	45·0
17/ 1/28 ...	25·7	1·55	18·2	70·7	44·4
23/ 1/28 ...	25·2	1·45	17·7	70·3	44·0
6/ 2/28 ...	25·3	1·85	18·7	73·8	44·5
9/ 2/28 ...	26·1	1·65	19·6	75·1	45·2
20/ 2/28 ...	27·7	1·90	20·4	73·7	45·2
6/ 3/28 ...	30·5	1·60	22·2	72·8	45·1
26/ 3/28 ...	30·4	1·80	21·6	71·0	45·0
Average ...	25·50	1·90	18·50		44·95

Clones Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
2/11/27 ...	26·2	1·75	18·0	68·6	44·7
16/11/27 ...	26·4	1·95	18·9	71·5	45·2
9/12/27 ...	25·9	1·80	19·2	76·8	43·4
23/12/27 ...	25·3	1·95	19·0	75·1	44·0
2/ 1/28 ...	25·5	2·00	19·0	74·5	44·2
16/ 1/28 ...	26·1	1·90	18·5	70·8	43·9
6/ 2/28 ...	26·7	1·85	19·3	72·3	45·2
27/ 2/28 ...	27·0	1·95	21·0	77·8	45·2
12/ 3/28 ...	28·1	2·20	20·3	72·2	45·2
26/ 3/28 ...	28·3	2·10	20·1	71·1	45·2
Average ...	26·55	1·95	19·08		44·62

Coachford Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
2/11/27 ...	24·2	1·60	17·8	73·5	46·0
16/11/27 ...	24·2	1·80	17·1	70·5	44·4
30/11/27 ...	24·0	1·65	19·0	79·2	45·2
14/12/27 ...	23·1	1·80	18·0	77·9	44·4
30/12/27 ...	24·1	1·90	18·0	75·0	44·4
16/ 1/28 ...	25·9	1·85	18·5	71·4	44·1
25/ 1/28 ...	28·4	1·85	20·8	73·3	44·4
8/ 2/28 ...	29·8	1·85	21·3	71·4	44·9
22/ 2/28 ...	30·9	2·30	21·7	70·3	45·1
7/ 3/28 ...	32·5	2·20	22·8	70·2	44·2
21/ 3/28 ...	30·0	2·10	22·0	74·0	45·1
Average ...	26·98	1·90	19·46		44·75

Effin Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
16/11/27 ...	24·2	1·75	17·5	72·9	43·9
28/11/27 ...	24·0	1·80	17·8	74·1	44·9
20/ 1/28 ...	25·2	1·75	18·1	71·8	43·9
3/ 2/28 ...	25·0	1·60	18·5	74·0	45·2
17/ 2/28 ...	26·0	2·00	19·1	73·8	44·8
2/ 3/28 ...	29·7	1·75	22·1	74·4	45·0
16/ 3/28 ...	30·7	2·20	22·6	73·5	45·1
30/ 3/28 ...	31·1	2·10	22·8	73·3	44·1
Average ...	26·98	1·87	19·69		44·61

Firies Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
4/11/27 ...	23·5	1·45	17·7	69·3	44·5
14/11/27 ...	25·2	1·80	18·0	71·4	44·2
28/11/27 ...	24·4	1·95	18·2	74·6	44·0
16/12/27 ...	24·0	2·00	18·5	77·1	43·5
24/ 1/28 ...	27·6	1·85	20·2	73·5	44·7
24/ 2/28 ...	31·5	1·95	23·7	75·2	44·0
9/ 3/28 ...	31·9	2·35	22·6	70·9	44·0
24/ 3/28 ...	31·8	2·10	23·3	73·2	43·7
Average ...	27·74	1·93	20·25		44·07

Glenmore Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
31/10/27 ...	23·0	1·45	17·5	76·0	45·5
11/11/27 ...	23·15	1·45	17·3	75·1	44·7
23/11/27 ...	22·9	1·40	17·6	76·8	45·0
9/12/27 ...	22·6	1·35	16·5	73·0	45·5
7/ 1/28 ...	26·2	2·40	18·4	70·3	43·7
24/ 1/28 ...	27·2	1·95	19·6	72·1	44·0
10/ 2/28 ...	29·5	1·90	21·9	74·4	44·9
22/ 2/28 ...	31·6	2·45	22·4	70·8	44·6
5/ 3/28 ...	31·5	2·00	22·4	70·9	44·2
23/ 3/28 ...	32·9	2·20	23·3	70·8	43·9
Average ...	27·05	1·86	19·59		44·60

Herbertstown Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
2/11/27 ...	25·4	1·35	17·9	70·5	45·8
16/11/27 ...	24·3	1·70	17·2	70·7	43·9
30/11/27 ...	24·0	1·50	18·4	76·7	44·7
19/12/27 ...	21·2	1·45	16·5	77·8	43·8
21/ 1/28 ...	23·3	1·60	17·5	75·0	44·4
11/ 2/28 ...	25·7	1·95	18·5	72·0	44·9
21/ 2/28 ...	27·2	2·05	20·5	75·5	44·9
1/ 3/28 ...	28·3	1·80	20·9	73·9	45·5
14/ 3/28 ...	28·9	2·10	22·1	76·4	45·2
26/ 3/28 ...	30·1	2·10	22·9	76·0	45·1
Average ...	25·70	1·76	19·44		44·82

KANTOHER CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
31/10/27 ...	24·6	2·10	17·9	72·7	45·2
15/11/27 ...	24·6	1·70	17·3	70·3	44·2
29/11/27 ...	23·5	1·60	17·3	73·5	44·7
14/12/27 ...	22·4	1·60	16·8	75·0	44·4
2/ 1/28 ...	23·5	1·85	18·1	77·0	43·8
16/ 1/28 ...	25·0	1·60	18·7	74·9	43·7
26/ 1/28 ...	26·7	1·75	20·2	75·1	44·4
8/ 2/28 ...	29·8	1·85	20·3	70·2	44·9
20/ 2/28 ...	27·9	2·05	20·2	72·5	44·2
9/ 3/28 ...	33·3	2·50	23·6	70·9	43·9
Average ...	26·13	1·86	19·04		44·34

KILLESHANDRA CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
31/10/27 ...	25·6	2·05	19·0	74·2	44·2
26/11/27 ...	24·5	1·60	17·6	69·4	44·0
7/12/27 ...	24·2	1·60	17·6	72·7	43·8
22/12/27 ...	22·3	1·50	17·1	76·7	44·6
5/ 1/28 ...	23·8	1·85	18·2	76·4	43·5
16/ 1/28 ...	24·8	1·80	18·2	73·3	43·9
30/ 1/28 ...	28·5	2·00	21·5	75·4	45·2
16/ 2/28 ...	25·8	1·95	18·6	72·1	45·0
1/ 3/28 ...	26·7	1·75	20·3	76·0	45·0
15/ 3/28 ...	27·7	2·00	20·2	72·8	44·4
22/ 3/28 ...	31·3	1·85	23·8	76·1	44·4
29/ 3/28 ...	27·8	1·85	19·7	70·8	44·4
Average ...	26·08	1·81	18·44		44·36

KILTEELY CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
8/11/27 ...	24·0	1·45	17·9	74·5	44·7
22/11/27 ...	24·1	1·60	17·9	74·3	43·0
30/11/27 ...	22·5	1·45	16·0	71·1	45·0
7/12/27 ...	22·0	1·70	16·1	73·2	45·2
23/12/27 ...	20·4	1·70	14·6	71·6	45·0
16/ 1/28 ...	22·3	1·55	16·2	72·7	44·1
26/ 1/28 ...	23·1	1·65	17·0	73·5	45·3
20/ 2/28 ...	25·3	1·75	19·9	78·7	45·6
9/ 3/28 ...	28·8	2·00	22·0	76·3	45·6
26/ 3/28 ...	29·8	1·65	22·9	76·8	45·2
Average ...	24·23	1·65	18·05		44·87

KNOCKLONG CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
3/11/27 ...	24·6	1·60	18·3	74·5	45·3
9/ 3/28 ...	28·4	2·00	21·4	75·5	45·0
23/ 3/28 ...	28·8	1·90	22·3	77·5	44·5
Average ...	27·26	1·83	20·80		44·91

LISTOWEL CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
29/10/27 ...	25·6	1·85	18·8	73·5	44·9
28/11/27 ...	24·2	1·65	17·7	73·2	44·7
3/12/27 ...	24·8	1·55	18·6	74·9	43·9
17/12/27 ...	24·1	1·65	19·1	79·2	43·7
24/12/27 ...	24·9	1·75	19·1	76·6	42·8
7/ 1/28 ...	26·1	1·90	18·5	70·8	44·0
20/ 1/28 ...	26·8	1·75	19·9	74·2	43·7
1/ 2/28 ...	28·3	1·85	19·8	70·0	44·3
15/ 2/28 ...	29·2	1·75	20·3	69·5	44·9
27/ 2/28 ...	29·5	1·90	21·8	73·9	45·1
14/ 3/28 ...	30·5	2·20	21·7	71·8	44·0
28/ 3/28 ...	31·4	2·30	22·9	72·9	43·6
Average ...	27·12	1·84	19·76		44·13

LIXNAW CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
7/11/27 ...	24·2	1·60	18·1	74·3	44·7
26/11/27 ...	24·3	1·50	17·3	71·2	44·7
16/12/27 ...	24·0	1·70	18·5	77·0	44·2
23/12/27 ...	23·8	1·90	18·5	77·7	44·0
7/ 1/28 ...	25·5	1·90	18·7	73·3	43·5
20/ 1/28 ...	26·2	1·80	20·3	77·4	43·5
3/ 2/28 ...	28·4	2·05	20·7	73·0	44·4
17/ 2/28 ...	29·8	1·90	21·4	71·8	44·4
1/ 3/28 ...	30·6	1·95	21·6	71·3	45·2
15/ 3/28 ...	31·2	2·05	23·6	75·6	44·0
29/ 3/28 ...	32·7	2·60	24·1	73·7	43·7
Average ...	27·34	1·90	20·50		44·21

LOUGH EAGISH CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
14/11/27 ...	24·7	1·40	17·8	72·0	43·8
7/12/27 ...	23·7	1·45	17·4	73·3	44·5
30/12/27 ...	23·5	1·70	18·2	77·4	43·7
20/ 1/28 ...	24·5	1·60	18·0	73·4	44·2
3/ 2/28 ...	25·2	2·25	18·4	72·9	45·2
17/ 2/28 ...	25·4	1·95	17·8	70·1	45·1
6/ 3/28 ...	25·4	1·40	18·6	73·2	45·2
27/ 3/28 ...	27·1	2·20	18·9	69·7	45·0
Average ...	24·94	1·78	18·13		44·58

MITCHELSTOWN CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
16/11/27 ...	24·4	1·65	17·0	69·6	44·9
21/12/27 ...	23·0	1·35	18·0	78·3	43·2
7/ 1/28 ...	24·9	1·75	17·7	71·0	43·9
18/ 1/28 ...	26·5	1·90	18·7	70·5	43·8
3/ 2/28 ...	25·8	2·00	20·6	79·6	44·9
15/ 2/28 ...	27·5	2·00	19·8	72·0	45·2
27/ 2/28 ...	30·9	2·30	22·7	73·5	44·0
21/ 3/28 ...	30·0	2·10	21·0	70·0	44·4
31/ 3/28 ...	31·4	2·15	22·8	72·6	44·3
Average ...	27·27	1·90	19·73		44·28

COUNTY MONAGHAN CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
31/10/27 ...	25·3	1·80	18·1	71·6	45·9
18/11/27 ...	24·8	1·50	17·6	70·9	45·0
5/12/27 ...	24·6	1·55	18·8	76·3	45·0
20/12/27 ...	24·6	1·85	18·9	76·8	42·7
3/ 1/28 ...	24·4	1·65	19·0	77·9	44·2
24/ 1/28 ...	24·2	1·70	18·5	76·3	44·3
7/ 2/28 ...	24·4	1·60	17·2	70·5	45·5
1/ 3/28 ...	25·1	1·55	18·7	74·4	45·4
20/ 3/28 ...	25·0	1·45	18·3	73·2	45·0
Average ...	24·7	1·63	18·35		44·78

Newmarket Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
14/11/27 ...	24·0	1·55	17·7	73·8	44·2
5/12/27 ...	22·6	1·40	17·0	73·2	44·5
21/12/27 ...	21·6	1·40	16·3	75·4	43·9
9/ 1/28 ...	26·3	2·20	18·7	71·1	44·3
23/ 1/28 ...	23·9	1·70	18·5	77·4	44·3
10/ 2/28 ...	26·7	1·60	20·0	74·0	44·4
22/ 2/28 ...	30·0	2·30	21·7	72·4	44·9
9/ 3/28 ...	29·5	2·00	21·3	72·3	44·7
21/ 3/28 ...	30·5	2·15	21·8	71·5	43·9
Average ...	26·12	1·81	19·35		44·36

Oola Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
7/11/27 ...	24·8	1·95	18·3	73·8	44·7
28/11/27 ...	23·1.	1·75	18·0	77·9	44·7
5/12/27 ...	21·9	1·50	15·9	72·2	44·5
23/12/27 ...	20·6	1·85	15·1	73·3	45·0
7/ 1/28 ...	21·6	1·60	16·4	75·9	44·2
21/ 1/28 ...	22·7	1·50	17·3	76·2	43·8
31/ 1/28 ...	23·9	1·60	17·8	74·5	44·9
14/ 2/28 ...	24·9	1·75	18·7	75·1	45·1
1/ 3/28 ...	29·5	1·95	22·9	77·7	44·7
12/ 3/28 ...	30·5	1·85	22·8	74·7	45·0
Average ...	24·36	1·73	18·32		44·66

Riverstown Creamery.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
7/11/27 ...	25·0	1·55	18·2	72·7	44·7
23/11/27 ...	24·4	1·80	17·2	70·4	44·0
9/12/27 ...	24·2	1·65	17·5	72·3	44·6
23/12/27 ...	23·8	1·85	18·3	76·9	43·3
7/ 1/28 ...	25·5	1·75	18·8	74·1	44·2
17/ 1/28 ...	24·6	1·60	17·5	71·1	44·2
31/ 1/28 ...	25·2	1·75	18·8	74·6	44·8
14/ 2/28 ...	25·0	1·75	18·9	75·6	45·2
28/ 2/28 ...	26·8	1·55	20·5	76·5	45·3
13/ 3/28 ...	26·0	1·85	19·0	73·1	45·0
27/ 3/28 ...	28·2	2·15	20·8	73·1	45·2
Average ...	25·34	1·75	18·61		44·59

SOLOHEAD CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
7/11/27 ...	25·1	1·75	18·4	73·3	43·7
21/11/27 ...	24·3	1·85	17·8	73·3	44·4
7/ 1/28 ...	21·7	1·60	15·9	73·3	43·9
19/ 1/28 ...	23·4	1·70	16·8	71·7	43·7
31/ 1/28 ...	23·1	1·40	16·8	72·7	45·9
14/ 2/28 ...	25·1	1·80	18·9	75·3	44·8
28/ 2/28 ...	27·4	1·55	20·6	75·3	45·1
19/ 3/28 ...	29·8	2·10	22·4	75·2	44·0
Average ...	25·22	1·73	18·73		44·43

TOURNAFULLA CREAMERY.

Date Taken.	R. M.	Polenske.	Kirschner.	K. as per cent. of R. M.	R. I. Zeiss° at 40° C.
2/11/27 ...	25·2	1·60	18·1	71·7	45·0
17/11/27 ...	25·2	1·70	17·6	69·9	44·8
30/11/27 ...	23·2	1·70	16·7	72·1	44·4
16/12/27 ...	22·8	1·70	17·3	76·0	43·8
3/ 1/28 ...	25·6	1·65	18·9	73·7	43·7
18/ 1/28 ...	25·3	1·85	19·0	75·1	43·6
27/ 1/28 ...	25·5	1·45	19·2	75·3	45·0
3/ 2/28 ...	27·4	1·80	20·2	73·7	44·4
15/ 2/28 ...	27·9	2·20	21·5	77·0	44·6
9/ 3/28 ...	29·8	1·90	22·6	75·9	44·3
23/ 3/28 ...	28·8	2·00	22·6	78·5	43·9
Average ...	25·51	1·76	19·24		44·33

NOTES AND MEMORANDA.

UNITED STATES FARM RELIEF BILL.

On 15 June, 1929, President Hoover signed the Farm Relief Bill, which he described as "the most important measure ever passed by Congress in aid of a single industry." At the same time he announced that he was asking Congress for an immediate initial appropriation of 150 million dollars of the 500 million revolving fund authorised by the measure.

The object of the Bill is to enable operations to be begun without delay under the provisions of the Agricultural Marketing Act, dated June 15, 1929, which is designed to help the American farmer to market his wheat and other products as advantageously as possible, and to provide for the distribution of surplus produce with a view to their more profitable disposal. For these purposes co-operative funds at low rates of interest will be provided. In short, it is proposed to regulate the market by systematically regulating supplies.

The revolving fund will be used in loans to agricultural co-operative societies and stabilization corporations for various commodities; it will be administered by a Board to be known as the Federal Farm Board. The selection of the members forming this Board will be a matter requiring some consideration. In the words of the President, "its members must in a measure be distributed regionally over the country; it must at the same time be chosen so as to represent as far as possible each major branch of agriculture. Moreover, the Board must be made up of men having actual farming experience, and, inasmuch as its work lies largely in marketing in conjunction with farm co-operatives, its membership should be comprised of men who have been actually engaged in directing farmers' marketing organisations. It is desirable that the Board should have in its constitution at least one man experienced in general business and one with special experience in finance."

The administrative task which lies before the Board is of much greater magnitude than anything of the kind hitherto attempted in the United States. In considering the Act under which the Board has been created, four things must be kept clearly in view: (1) the Federal Farm Board; (2) the ultimate 500 million dollar revolving fund for loans; (3) the farmers' co-operative associations; and (4) the stabilizing corporations. These comprise the fundamental framework of the new system.

Under the Act, the Government will deal, not with individuals, but with the farmers' co-operative associations, which have sprung up in thousands under what is known as the Capper-Volstead Act of 1922. All the co-operatives engaged in handling a certain commodity will have a Commodity Advisory Committee. In other words, there will be one such committee for each commodity or crop: wheat, cotton, potatoes, pigs, sheep, etc. The Commodity Advisory Committee will be composed of seven men, all pro-

ducers of that particular commodity. They will draw no salary, but will receive an allowance of 20 dollars per day and expenses for attendance at meetings. These committees will act as intermediaries between the actual producers and the Federal Farm Board, which controls the revolving fund.

Every commodity too will have its stabilizing corporation, which must be farmer-owned and farmer-controlled. Co-operatives must own the stock of the stabilizing corporation, and the latter must be incorporated under the laws of some State. The stabilizing corporation has a twofold function: (*a*) it may act as a marketing agency for the co-operatives of its commodity group, and (*b*) it may go out into the market in times of depression and with money furnished by the Federal Farm Board buy up a surplus crop and store it while awaiting a better price, or sell it abroad if there is an advantage in so doing.

The Board may lend money to a co-operative association on the security of the commodity in which they deal; such loans may bear interest up to 4 per cent. As regards the specific objects for which associations may obtain loans from the Federal Farm Board, they are of many different kinds. For instance, a co-operative association which handles wheat may find itself badly handicapped for want of an elevator, and may want money to build one. An application to the Farm Board may result in a loan equal to 80 per cent. of the value of the stored wheat and at a rate of interest between 3 and 4 per cent. Or an onion-growers' association may need, say, 50,000 dollars, to build a warehouse, and may borrow from the federal revolving fund. Again, an association of pig-breeders may decide that it would be more profitable to them to market their stock in the form of pig products rather than on the hoof; they too may apply to the Board for money to set up a packing plant. A farmer who belongs to a co-operative association may haul a load of wheat to the co-operative warehouse and, by paying a small premium, take out insurance that will protect him against any drop in wheat below a stipulated price. If wheat falls below that price, what would otherwise be his loss will be made up out of the revolving fund, but if, on the other hand, wheat rises above the guaranteed price, the farmer, when he sells, will receive the benefit of that increase.

These are only a few typical examples of how the new Act will work. In fact, if a co-operative association wants money for almost any process of farming or marketing, it has only to make out a good case to the Federal Farm Board. The scheme is thus one of very great magnitude, and its practical working out will be watched with interest. That it presents elements of difficulty will not be denied. One of the legislators who voted for the Bill has frankly admitted that "no one can foresee the outcome of this super-scheme of federal farm relief. About the utmost that can be said is that it opens the way to a vast uncharted sea of experimentation, and there will likely be a great deal of sailing on that sea before the Congress finds the port named Success. I can foresee emendatory legislation for many years to come. The Act places at the disposal of the farmer prodigious credits, and whether or not it succeeds depends largely on how wisely it is administered.

WARBLE-FLY CONTROL ON THE CONTINENT.

The Belgian Ministry of Agriculture have issued an Order concerning the control of the warble-fly. This Order abrogates the measure of 17th March, 1924.

Every owner or keeper of cattle is obliged to destroy the larvae of the fly in accordance with the instructions issued annually by the Ministry. Animals in which larvae have not been destroyed may not be offered for sale at a public market, and must be kept effectively isolated from all other animals. Veterinary inspectors and police must keep a strict watch to ensure the execution of this measure. They must seek out affected animals and order the owner to destroy the larvae within a period not exceeding 15 days. If the owner does not comply with this order, he renders himself liable to prosecution and penalties according to Articles 4 and 6 of the law of the 30th December, 1882. Moreover, the Veterinary Inspector may have the larvae destroyed by an expert at the owner's expense.

In the circular accompanying the Order, the Ministry recommend that larvae should be destroyed in the spring, and that all animals, even those which have been treated, should be examined every three weeks. The larvae are removed by gentle pressure on the swellings which appear on the hide. The " squeezing-out " should be done immediately these swellings appear. If necessary, a lancet may be used to open the tumors, and a forceps to pick out the larvae. The wound heals quickly without suppuration. If the intervention is timely, the milk yield of cows is increased; the meat of animals intended for slaughter does not depreciate in quality, nor is the value of the hide lessened.

The systematic destruction of warbles carried out from 1902 to 1911 in Denmark and in certain districts in Germany has proved that the almost complete disappearance of the Warble-Fly can be effected.

The extraction method is the one generally practised in Denmark, but various chemical preparations are used elsewhere to dress the warbles and destroy the grub. For instance, *hypocotine*, a preparation of tobacco, is recommended by the Swiss Warble-Fly Control Committee as practical, simple, effective and cheap. Hypocotine is also used in Italy. In France *dichlorbenzol* ointment is reported to be used successfully, and *phenic* ointment is used in Germany as a dressing.

CANADIAN EGGS FOR THE ARGENTINE.

A sample shipment of eggs has been sent by the Department of Agriculture, Ottawa, to Buenos Aires. The consignment consisted of 8 boxes (Jumbo style), 30 dozen Canadian fresh extras, and 8 boxes (Jumbo style), 30 dozen Canadian firsts. Their condition on arrival was found to be satisfactory, except that two boxes had been damaged in transit. The eggs were put on view in the early market, when some sixty buyers had the opportunity of handling and commenting on the packing, size, cleanliness,

quality, and general selection of the produce. Without exception, the trade expressed a very high opinion of the shipment. Two sample boxes, one of each class, were sold to each of six of the larger buyers. A visit was afterwards paid to their establishments, and in each case full satisfaction was expressed and inquiries made as to when the first shipment of eggs for sale was likely to arrive. As Buenos Aires is a price market, it was stated that the fresh firsts would command favour if there was a marked difference in price, as the public, with few exceptions, consider price first rather than a slight difference in the size of the eggs. The local eggs sell at a premium of about 2 cents gold per dozen over imported. Prices of imported eggs are not officially recorded and are very intermittent. This information is, however, easily obtained from telegrams offering eggs from abroad.

The quantity of shell eggs received into Argentina from other countries during the months of March, April, May, and June is quite large. Apart from these four months, importation may be considered as negligible. During the months March to July, 1928, the imports of eggs in cases of 30 dozen were as follows:—

From N. America	211,722
,, Holland	50,810
,, Italy	33,048
,, Ireland	29,291
,, Germany	24,788
,, Poland	1,504
,, France	554
	351,717

IMPERIAL BUREAU OF SOIL SCIENCE.

The Imperial Bureau of Soil Science (one of the 8 Bureaux, the formation of which was recommended by the Imperial Agricultural Research Conference of 1927) commenced work on the 1st May at the Rothamsted Experimental Station. Sir John Russell, Director of Rothamsted, is also the Director of the Bureau, and Dr. A. F. Joseph, lately Sudan Government Chemist, has been appointed Deputy Director.

The functions of the Bureau include the collection and distribution of all research work on soils of importance to the British Empire, the assistance of research workers in the prosecution of their investigations in whatever ways it can, the bringing together of workers from different parts of the Empire (either by correspondence or in conference) interested in the same subjects, and to supply information generally which may facilitate the work of soil experts in the development of agriculture.

It is hoped that before long the Bureau will be in close touch with all soil investigators of the Empire, both at home and abroad, and that by

means of information-circulars and other methods, the results of studies carried on in one part of the Empire will be made available for all.

Arrangements will also be made to supply information dealing with soil investigations in foreign countries, the results of which (owing to language or other difficulties) are not readily available.

SUGAR BEET GROWING IN SWEDEN.

The Swedish sugar beet crop, the extent of which was hitherto based on the amount of sugar consumed in the country, will be reduced this year by 50 per cent., because Parliament has refused any support to the beet growers in their present difficult position.

The Government party has proposed that the tax on table sugar be increased from 10 to 12 crowns per 100 kg. (about 10s. 9d. to 12s. 10d. per 2 cwts.), but in order that the consumer might not be burdened by this increase, the abolition of the sugar duty is also suggested. The Opposition refused to listen to his suggestion, and proposed direct State subsidies. The Government's supporters refused to agree to this suggestion, with the result that Swedish sugar beet can count on no State support other than that of the present insufficient tariff duty. The majority of farmers would willingly give up the cultivation of beet, but they are bound by a five years' contract to the Sugar Company. The contract, however, allows for a decrease of 50 per cent. in the amount of beet to be produced when the circumstances are exceptional, and most farmers will escape under this proviso.

The Swedish farmers have had to abandon all hope of protection for their produce, and are now setting about reforming their methods of farming to suit the present state of political affairs. By increasing the extent of their pasture lands, and especially by putting waste-lands under grass, they have been able to maintain and even extend their cattle industry; by a better organisation of labour and the adoption of labour-saving devices in field and farmhouse, they have been able to reduce the number of hands employed without losing in efficiency or reducing crop yield.

In Sweden, as in most other countries, agriculture is in a bad way, but the above measures have to some extent made it pay, notwithstanding the fact that prices are low and expenses high. According to the latest reports, Swedish agriculture for 1927-28 showed a nett profit of 34 crowns per hectare, or about 15s. 2d. per acre, which amounts to 2 per cent. interest on agricultural capital.

A PROFESSORSHIP IN MARKETING.

The Minister of Agriculture for Prussia has appointed Dr. Karl Brandt, formerly Director of the Prussian Central Bank, to the staff of the Agricultural College of Berlin, where he is to occupy the newly-created post of Professor of Marketing. This post carries with it the directorship of the

"Prussian Institute for Agricultural Marketing Research," which has recently been established in connection with the College. The question of the marketing of agricultural produce is being studied very earnestly in Germany at present, but it has not yet passed much beyond the stage of certain exploratory experiments. In other countries, notably in America, the results of several decades of study and of the outlay of vast sums of money are now available, and the German Ministry of Agriculture have accordingly directed Professor Brandt to make a six-months' study tour in Canada and the United States. Great benefits to the German farmer are hoped for from this application of scientific training and specialised knowledge to the problem of marketing agricultural produce.

FLUKE CONTROL IN NEW SOUTH WALES.

The Department of Agriculture of New South Wales is doubtful if any of its work has had such rapid results as the recommendations regarding the treatment of fluke-infected sheep with carbon tetrachloride. The drug is now in general use in the known fluke-infested districts. In districts where it was unsafe hitherto to keep sheep, owners have stated that they no longer fear the fluke, and information is to hand that, following the discovery of the efficacy of the drug, properties on the eastern fall of the mountains have already increased in value. Some instances of losses in sheep following the use of carbon tetrachloride have been reported, but the reason for these losses is obscure.

Carbon tetrachloride has been found equally efficacious with cattle, but there appear to be indications that it has somewhat untoward effects on milch cows. The District Veterinary Officer (North) states that information has been received that the milk is tainted by the drug, that cattle lose their appetite, and that the milk supply diminishes for a week or so after the administration of the drug.

By continuing the treatment of the sheep with carbon tetrachloride, and so destroying the fluke, and the treatment of the watercourses, swamps and springs with copper sulphate, in order to destroy the snails, the eradication of fluke on any property may be rapidly brought about. What was considered one of the chief drawbacks to sheep-raising in the tableland districts of New South Wales has thus been completely overcome.

WORLD AGRICULTURAL CENSUS, 1930.

Mr. L. M. Estabrook, Director of the World Agricultural Census, 1930, has just returned to Washington after an 11,000 mile trip through Central and South America. The inclusion of these countries in the census brings the total representation in the project to about 97 per cent. of the land surface, 98 per cent. of the total population, and approximately 99 per cent.

of the total agricultural production of the world. The only countries not visited by Mr. Estabrook since his appointment as Director in 1925 are Afghanistan, Persia, Bolivia, and some of the West African colonies and small islands in which agriculture is relatively unimportant but for which co-operation has been promised by their home Governments.

The undertaking of a world census of agriculture in 1930 was approved by the General Assembly of the International Institute of Agriculture at Rome in 1924, and the preliminary work of organising the census was made possible by the co-operation of the International Educational Board, the U.S. Department of Agriculture, and the International Institute of Agriculture. The purpose of the census is to provide more complete, accurate, and comparable international statistics relating to agriculture; to provide a secure basis for annual crop reports and statistics, and to improve the agricultural statistical organisation of many countries. It will be the first census ever attempted in all countries of the world in the same year and according to the same general plan. It is hoped that the census will be repeated every ten years.

NEW SWISS BUTTER BRAND.

The Central Union of Swiss Milk Producers has decided to introduce a butter brand with the view to increasing the home production of butter. This brand will apply only to first-class butter made from separated cream collected at the stations under the management of the Central Union. These cream-collecting stations turn out butter which, in taste and keeping qualities, is equal to the best foreign butter and which, moreover, has the advantage of being fresher, because of the short distance it has to travel. The Alpine Brand (a gentian flower with the word " Floralp " beneath) gives a guarantee of excellent butter, and also shows the country of origin. This is all that Swiss butter producers are in a position to do, for the reason that the compulsory stamping of foreign butter has been found impracticable.

The creameries which supply this " Floralp " butter are subject to inspection by the Central Swiss Butter Bureau in Berne, which supplies wrapping paper bearing the brand and supervises its use. The butter is regularly examined by an inspector, and in cases where the quality is unsatisfactory or where a breach of contract occurs, the right of using the stamp may be withdrawn either permanently or for a time.

PIG-FATTENING EXPERIMENTS IN FRANCE.

The object of these experiments, which were carried out at the national live stock breeding station at Grignon, was to test the fattening value of some of the most commonly used pig-feeding materials.

In each of the series of experiments, which lasted about three months, groups of three pigs, as much alike as possible, received in turn rations

composed of different foods having practically the same nutritive value. Each feeding period lasted from twenty to thirty days, and the pigs were weighed at regular intervals.

In the first series the special foods tested were barley meal, Indian meal, and bran. Each group received a daily ration of 8.25 lb. peanut cake and 23.1 lb. potatoes, plus 9.9 lb. barley meal, or 8.9 lb. Indian meal, or 13.8 lb. coarse bran, respectively. The average daily increase per group (3 pigs) worked out as follows:—Indian meal 4.69 lb., barley meal 4.3 lb., bran 2.9 lb.

The second series of experiments were designed to show in what form whole Indian corn is best assimilated by pigs when, as frequently happens on small farms, it cannot be ground or crushed. It was fed to the pigs either cooked or raw, or soaked in water for 48 hours. The daily ration of all three groups consisted of 3.3 lb. peanut cake and 16.5 lb. potatoes, plus 6.6 lb. of whole maize (raw, boiled or soaked). The average daily weight increase recorded when boiled maize was given amounted to 4.6 lb.; when raw maize was fed, it was 4.5 lb., and when the maize was soaked beforehand in water the increase in weight was only 4.3 lb. Thus, the best result was achieved with boiled maize, but the extra increase in weight did not cover the cost of cooking.

The object of the third series of tests was to find out whether the Indian meal (raw or boiled) used in conjunction with potatoes and peanut cake was preferable to soaked maize for fattening pigs. In this case, the daily ration consisted of 5.5 lb. peanut cake and 18.7 lb. potatoes, with the addition of 6.6 lb. Indian meal (raw or boiled) and of soaked maize. The average daily weight increase per group was 4.7 lb. in the case of raw Indian meal, 3.8 lb. in that of boiled Indian meal, and 3.5 lb. in that of raw maize soaked in water. The advantage thus clearly rests with the raw Indian meal, which moreover, is also the most convenient to use.

In the first experiment the three pigs which had received raw maize meal as a supplemental ration increased by 4.69 lb. per day; in the third experiment this increase was 4.79 lb., or practically the same result with different animals, and at an interval of six months.

An experiment in pig fattening with tapioca is still in progress.

EGG-PRESERVING METHODS TESTED.

The South African Department of Agriculture have published a report on an experiment carried out at the School of Agriculture, Potschefstroom, in 1927-28, on the efficiency of certain egg preservatives. As a result of the investigations made, the Department's Research Officer has arrived at the following conclusions:—

(1) That liquid preservatives are far better for the preservation of eggs than dry preservatives.

(2) That ordinary slaked lime preserves eggs only for a period of one month.

(3) That wheat, bran and common salt are about equal in their preserving qualities. Eggs stored in these media have been considered suitable for eating purposes after a period of three months, and for cooking purposes after a period of five months.

(4) That egg-wrappers cannot be recommended as a safe medium of preservation for a period of time exceeding three months for eating and four months for cooking.

(5) That " ovoline " has the property of keeping eggs wholesome for both eating and cooking purposes for a period of five months, but that deterioration sets in rapidly after a period longer than five months.

(6) That water-glass has proved itself superior to all the other media tested and will, under ideal conditions of holding, preserve eggs for eating for six months and for cooking for at least eight months.

(7) That lime and salt solution kept eggs wholesome for eating purposes for five months, but, like " ovoline," the eggs showed deterioration rapidly after this period.

(8) That there appears to be no appreciable difference in the preservative action of the foregoing media on white and brown eggs.

(9) That evaporation of moisture is very marked when eggs are stored in a dry preservative and that liquid preservatives check evaporation to a marked degree.

A special process known as " Guaranizing " is practised in U.S.A. This process consists in immersing the eggs for a few seconds in a preparation of refined oil at a high temperature. This is said to seal the shell effectively without allowing the oil time to penetrate to the contents. When large quantities are handled, the cost of oil is about a half-penny per dozen.

In Belgium a method of preservation—the gas process—has been carried out successfully for the past three years. It is described as a process for preserving eggs by refrigeration in an antiseptic atmosphere. The eggs are placed in autoclaves or large cylinders which, after as complete a vacuum as possible has been obtained, are hermetically sealed. A mixture of nitrogen and carbon dioxide is then pumped in until a pressure slightly above the atmosphere is reached, and this is maintained throughout the storage period. The autoclaves are kept permanently in cold chambers at a temperature 0°C. It is claimed that the eggs are sterilized by the process and all possibility of decomposition effectively checked; also that on removal from the autoclave, they are not only in as good a condition as when put there, but will retain condition for a longer period than unsterilized new-laid eggs. The cost, estimated at approximately a half-penny per egg, is high, but the value of the eggs is said to be higher than that of eggs preserved by ordinary cold storage methods.

IMPORTATION AND EXPORTATION OF HORSES: BELGIAN REGULATIONS.

On the 18 June, 1929, a decree containing the following provisions was issued by the Belgian Government:—

(1) Racehorses or horses used for sport of any kind passing the frontier in either direction for a stay not exceeding six months in Belgium or abroad are exempt from all formalities of a sanitary nature. If they remain for a longer period they must be officially examined. The mallein test will be applied only in cases where glanders is suspected.

(2) In case of dispute, the frontier police will decide whether the animals in question belong to the category of horses used for sport or not.

CONSUMPTION OF RYE BREAD IN GERMANY.

In the course of a lecture on the bread question in Germany, delivered at the first annual meeting of the Imperial Food Supply Association, Dr. Hahn, Director of the Hygienic Institute of Berlin University, made a report on the investigations carried out by the Scientific Committee of the Association. He declared that the enormous importation of wheat into Germany was the chief point at issue. The value of this import, which in 1923 amounted to 174 million marks, had risen to 653 million marks in 1927. As compared with rye, Germany's wheat production stands in the proportion of 30 to 70, while her wheat consumption is in the proportion of 45 to 55.

After the war, the mass of the people took to an increased consumption of white bread, which contributed greatly to a passive trade balance. The question whether the increased use of wheat is justified from a nutritive and physiological point of view must be answered in the negative, in consideration of the very slight difference which exists in favour of wheat as regards its assimilation by the human organism.

The idea that rye bread is indigestible applies only to specially delicate persons. For the present the essential need is that pure rye bread should regain its former position of national importance, a position well deserved, on account of its food value and special flavour. A "back to rye bread" movement is absolutely necessary if the German trade balance is to be improved.

THE WHEAT PROBLEM IN FRANCE.

France has always been a great wheat producing country, but, since the war this production has been decreasing steadily. Not only in France, but all over Europe has the cultivation of wheat fallen off. In France from 1909-1913 the average yearly production of wheat was 8½ million tons, but during the period 1923-1927 that figure dropped to 7¼ million tons. This is due to the fact that owing to the expenses connected with the cultivation

of wheat, *e.g.*, cost of agricultural implements, labour, etc., and the low import duties on foreign wheat, the farmer no longer finds it a remunerative crop, hence the acreage under wheat in France has decreased by about a fifth. In 1928, France had to import about one million tons of wheat, notwithstanding the fact that the amount of bread consumed has decreased, owing to the greater consumption of meat in recent years.

An official statement declares that wheat can be remunerative in France only if

(*a*) the yield per acre is increased, or

(*b*) an adequate protective tariff on imported wheat be imposed.

Since the war the duty on imported wheat has apparently not proved itself sufficient. Before the war, the duty on wheat was 9 francs per 220 lb. This represented about 25 per cent. of the value of the wheat. The duty was subsequently raised to 18.20 francs and later to 35 francs, or about 22.5 per cent. the value of the wheat. In May, 1929, the wheat duty was again raised to 50 francs per 220 lb., at which figure it now stands.

In order to compensate for the decline in acreage, French agriculturists are making every effort to increase the yield of grain. In 1921 and 1925, an average yield of 12½ cwts. per acre was obtained, as compared with 10 cwts. in the years before the war. In the Nord Department, yields of from 19 cwts. to 1.2 tons per acre are obtained.

It is believed that France, in conjunction with Northern Africa, should not only be able to provide sufficient wheat for her own needs, but should also be in a position to export her surplus production.

FARM LEASES IN BELGIUM.

A law dealing with farm leases has been recently passed in Belgium. The measure, which is dated 9th March, 1929, embodies four essential ideas: (1) a guarantee of tenure for a minimum period; (2) a recognition of the farmer's right to cultivate any crop he likes; (3) sufficient notice before a farmer may be turned off his holding; and (4) the right of an outgoing tenant farmer to indemnity for increased value due to improvements.

The shortest lease must now extend over a period of 9 years, and the farmer has full liberty to cultivate whatever crops he pleases. This condition will have the effect of doing away with a number of old clauses, which have become almost stereotyped in Belgian leases, under which the raising of crops which were supposed to cause deterioration of the soil was forbidden. One interesting restriction has, however, been retained, namely the limitation of the rights of farmers as regards the disposal of stable manure produced during the time of his occupation. This is a wise measure which ensures the retention of a certain amount of fertilising material for the incoming tenant.

The Belgian law does not admit the right of the tenant to plant himself upon the landlord, but the landlord must give his tenant two years' notice before evicting him. As regards the difficult question of compensation for

improvements, the matter has been arranged in the following way: for buildings, plantations and other permanent improvements, the landlord either agrees in writing to compensate the farmer, or he does not agree, so that the tenant knows exactly where he stands. If such an agreement exists, the farmer must leave behind all such permanent improvements, receiving in return compensation proportionate to their value. Should no written agreement have been made, the landlord may require the outgoing tenant to remove any buildings, etc.. which he may have put up, or he may offer a price for them proportionate to the tenant's outlay.

If the tenant can show that he has improved the land either by the use of fertilisers or the destruction of weeds. he is entitled to a certain compensation. but this is a matter which is very difficult to arrange to the satisfaction of both parties. Sometimes. if the land needs to be treated with lime or marl and the tenant does this at the beginning of his term as tenant, the landlord reduces his rent for the first few years.

THE COLORADO BEETLE: A WARNING FROM GERMANY.

In the course of a recent article on the pests which usually attack tillage crops in Germany, Dr. S. Wilke, Dahlem, mentions that potatoes in that country are happily fairly free from attacks by insect pests, but he adds "one very dangerous pest, however, threatens us from France, the Colorado or Potato Beetle. Owing to its steady advance in that country, the risk of its introduction into Germany is constantly increasing and it is urgently necessary for us to be on the alert. Our experience in former outbreaks has taught us that it is generally about this date (mid-July) that it is discovered in the fields. Every farmer should, therefore, examine his potato fields carefully; if he should find any pest which appears to resemble the Colorado Beetle, he should at once send a few of the suspected insects to the nearest Plant Protection Station, to the local Chamber of Agriculture, or to the Imperial Institute for Agricultural and Forest Biology, Dahlem, Berlin, for examination."

NEW SWISS GRAIN LAW.

Switzerland's grain monopoly ended on 30th June, in conformity with the result of the national referendum. The effect will be that the war-time measure is discarded and replaced by a system based on the statistics of imports and exports.

The new law, which is to guarantee Switzerland a sufficiency of bread corn, is modelled very closely upon the old war-time measure. Many of the old provisions, such as the maintenance of grain reserves, the subsidy for domestic grain, protection of the domestic milling industry, and the intensive supervision of milling still remain. On the other hand, however, the mills are now able to purchase grain where and when they wish.

It has been thought best to require a certain reserve store of grain to meet any emergency which might arise. Thus the Government is bound to hold for its own account at least 80 thousand tons which, in addition to the stock carried by the mills and that provided from domestic sources, would provision the country for about three months. This reserve may be increased, if necessary. One-half of the reserve must be stored and cared for free of charge by the commercial mills of the country, in proportion to the amount of grain handled during the previous year.

The Federal Government plans to continue its policy of buying all native bread grain direct from the grower. The local farmers' societies will, however, act as intermediaries. All grain delivered to the Confederation, either f.o.b. wagon, or at a mill or grain elevator, will be bought at the average price of foreign grain of equal quality delivered customs paid at the Swiss border, plus a bounty equal to 8.50 francs over the ruling world market price. The total purchase price must be a minimum of 40 francs per 100 kilos, as compared with 38 francs previously. The milling premium paid by the Government to Swiss millers amounts to 7.50 francs per 100 kilos, as against 5 francs under the monopoly, while millers in mountain regions now receive 11 francs instead of 8 francs.

The new regime will restore to the commercial mills the right to buy the greater part of their grain where they will. On the other hand, they will still be subject to certain regulations, especially those concerning the storage of grain and the acceptance of domestic grain purchased by the Confederation. The commercial mills are also obliged by the new law to store, free of charge, for the Confederation, 40,000 tons of grain. The Confederation will also maintain, in its own elevators, another 40,000 tons.

The Federal Bureau of Statistics report that the domestic wheat crop has increased steadily from 1926 to 1928. The yearly home production, estimated at 193,200 metric tons in 1926, reached 205,800 metric tons in 1928. From 1926 to 1928, home producers supplied 30.7 per cent. of all the wheat consumed in Switzerland. Notwithstanding this increase in home-grown wheat, it is interesting to note that the imports in 1928 exceeded those of 1926 by over 19,714 tons. This is not attributed to a larger bread consumption, but rather to the fact that the Government increased their wheat reserves by more than 40,000 tons during the period December, 1925, to December, 1928.

TABLES SHOWING THE EXPORTS

TABLE

RETURN of the NUMBER of ANIMALS EXPORTED from IRELAND to
31ST DECEMBER, 1929, showing the PORTS

PORTS IN IRELAND.	CATTLE.						SHEEP.			
	Fat.	Stores	Milch Cows.	Spring-ers.	Calves.	Total.	Fat.	Stores.	Lambs.	Total.
Irish Free State Ports:—										
Ballina ...	662	113	4	6	5	790	4,120	—	7,994	12,114
Cork	11,485	51,024	1,421	7,256	23,336	94,522	2,276	72	8,009	10,357
Drogheda ...	23,913	10	1	3	3	23,930	4,719	—	21,972	26,691
Dublin... ...	224,240	132,641	33,917	1,514	7,146	399,458	157,955	62	216,154	374,171
Dundalk ...	10,038	515	7	—	—	10,560	11,934	—	23,023	34,957
Galway ...	15	348	—	—	—	363	1,318	—	4,671	5,989
Greenore ...	2,502	32,194	1,670	1,195	—	37,561	7,704	—	29,436	37,140
Limerick ...	1,737	5,642	—	—	—	7,379	46	28	36	110
Rosslare ...	—	—	—	—	—	—	—	—	—	—
Sligo	1,241	1,193	3	5	263	2,705	456	—	13,454	13,910
Waterford ...	29,986	36,798	271	1,851	11,812	80,718	13,649	—	17,229	30,878
Westport ...	271	—	—	—	—	271	—	—	—	—
Wexford ...	2,122	—	—	—	—	2,122	1,491	—	4,325	5,816
TOTAL ...	308,212	260,478	37,294	11,830	42,565	660,379	205,668	162	346,303	552,133
Northern Ireland Ports:—										
Belfast ...	21,014	63,252	15,058	3,213	25	103,462	26,805	87	39,883	66,775
Larne	61	32,704	13	407	1,551	34,736	124	292	4,648	5,064
Londonderry ...	10,751	58,039	900	1,403	13,533	84,626	11,740	5,081	21,462	38,283
Newry ...	36	173	30	12	—	251	378	—	160	538
Total ...	31,862	154,168	16,901	5,035	15,109	223,075	39,047	5,460	66,153	110,660
All Irish Ports:—										
Total ...	340,074	414,646	54,195	16,865	57,674	883,454	244,715	5,622	412,456	662,793

TABLE

RETURN of the NUMBER of ANIMALS EXPORTED from IRELAND to
31ST DECEMBER, 1929, showing the PORTS of DEBARKATION

PORTS IN GREAT BRITAIN AND THE ISLE OF MAN.	CATTLE.						SHEEP.			
	Fat.	Stores.	Milch Cows.	Spring-ers.	Calves.	Total.	Fat.	Stores.	Lambs.	Total.
England.										
Bristol ...	719	11,355	99	831	3,874	16,878	1,067	—	340	1,407
Fishguard ...	7,239	51,381	1,544	8,025	19,566	87,755	3,690	41	2,723	6,454
Heysham ...	13,582	30,029	10,237	1,879	125	55,852	30,608	5,166	46,223	81,997
Holyhead ...	69,622	75,633	20,399	2,068	1,522	169,244	67,596	62	102,454	170,112
Liverpool ...	175,535	47,267	7,986	685	6,861	238,334	109,374	59	214,703	324,136
Manchester ...	16,536	30	10	—	2	16,578	11,213	—	7,166	18,379
Newhaven ...	—	—	—	—	—	—	—	—	—	—
Plymouth ...	—	—	—	—	—	—	—	—	—	—
Preston ...	24,411	2,027	5,813	90	85	32,426	20,444	—	29,939	50,383
Silloth ...	664	10,956	161	9	139	11,929	—	—	—	—
Southampton ...	—	—	—	—	—	—	—	—	—	—
Scotland.										
Ardrossan ...	—	—	—	—	—	—	—	—	—	—
Ayr ...	1,216	31,367	578	312	169	33,642	—	2	—	2
Glasgow ...	29,216	77,876	6,407	2,322	20,424	136,245	590	—	4,240	4,830
Greenock ...	727	49,086	940	239	3,300	54,292	—	—	20	20
Stranraer ...	45	27,301	13	384	1,551	29,294	124	292	4,648	5,064
Isle of Man.										
Douglas ...	562	338	8	21	56	985	9	—	—	9
TOTAL ...	340,074	414,646	54,195	16,865	57,674	883,454	244,715	5,622	412,456	662,793

AND IMPORTS OF ANIMALS.

I.

GREAT BRITAIN and the ISLE OF MAN during the Year ended
OF EMBARKATION IN IRELAND.

Pigs.			Goats.	Horses.				Mules or Jennets.	Asses.	Total Animals.	PORTS IN IRELAND.
Fat.	Stores.	Total.		Stallions.	Mares.	Geldings.	Total.				
											Irish Free State Ports.
3,678	—	3,678	—	—	—	—	—	—	—	16,582	Ballina.
90,403	232	90,635	1	2	173	305	480	—	13	196,008	Cork.
56	—	56	1	—	—	—	—	—	—	50,678	Drogheda.
85,241	239	85,480	18	478	1,769	1,420	3,667	—	94	862,888	Dublin.
304	—	304	171	—	1	2	3	—	—	45,905	Dundalk.
824	—	824	—	—	—	—	—	—	—	7,176	Galway.
12,030	—	12,030	18	—	718	677	1,395	—	43	88,187	Greenore.
49	—	49	—	—	2	7	9	—	—	7,547	Limerick.
—	—	—	—	—	4	9	13	—	—	13	Rosslare.
17,725	—	17,725	5	—	—	—	—	—	—	34,345	Sligo.
37,413	—	37,413	3	4	765	797	1,566	1	32	150,611	Waterford.
—	—	—	—	—	—	—	—	—	—	271	Westport.
18	—	18	—	—	—	—	—	—	—	7,956	Wexford.
247,741	471	248,212	217	484	3,432	3,217	7,133	1	182	1,468,257	TOTAL.
											Northern Ireland Ports.
12,190	89	12,279	15	9	525	1,079	1,613	15	35	184,194	Belfast.
1,612	3,149	4,761	7	4	25	100	129	—	6	44,702	Larne.
3,575	66	3,641	—	—	12	28	40	—	11	126,601	Londonderry
29	—	29	—	—	—	—	—	—	—	818	Newry.
17,406	2,304	20,710	22	13	562	1,207	1,782	15	52	356,316	Total.
											All Irish Ports.
265,147	3,775	268,922	239	497	3,994	4,424	8,915	16	234	1,824,573	Total.

II.

GREAT BRITAIN and the ISLE OF MAN during the Year ended
in GREAT BRITAIN and the ISLE OF MAN.

Pigs.			Goats.	Horses.				Mules or Jennets.	Asses.	Total Animals	PORTS IN GREAT BRITAIN AND THE ISLE OF MAN.
Fat.	Stores.	Total.		Stallions.	Mares.	Geldings.	Total.				
											England.
595	—	595	—	—	18	12	30	—	11	18,921	Bristol.
102,148	109	102,257	4	6	874	1,037	1,917	1	33	198,421	Fishguard.
13,593	33	13,626	10	6	345	592	943	15	28	152,471	Heysham.
88,725	138	88,863	21	460	2,373	1,901	4,734	—	104	433,078	Holyhead.
49,106	124	49,230	186	9	116	167	292	—	18	612,196	Liverpool.
—	—	—	2	—	—	—	—	—	6	34,965	Manchester.
—	—	—	—	—	6	3	9	—	—	9	Newhaven
—	—	—	—	—	1	—	1	—	—	1	Plymouth.
1,073	—	1,073	3	—	2	—	2	—	—	83,887	Preston.
855	—	855	—	—	23	20	43	—	—	12,827	Silloth.
—	—	—	—	—	2	2	4	—	—	4	Southampton.
											Scotland.
—	—	—	—	1	59	207	267	—	2	269	Ardrossan.
326	30	356	1	—	4	45	49	—	—	34,050	Ayr.
7,141	5	7,146	5	9	101	301	411	—	10	148,647	Glasgow.
26	60	86	—	—	3	9	12	—	7	54,417	Greenock.
1,559	3,149	4,708	7	4	25	99	128	—	6	39,207	Stranraer.
											Isle of Man.
—	127	127	—	2	42	29	73	—	9	1,203	Douglas.
265,147	3,775	268,922	239	497	3,994	4,424	8,915	16	234	1,824,573	TOTAL.

IMPORTS OF ANIMALS INTO IRELAND FROM GREAT BRITAIN AND THE ISLE OF MAN.

The number of Animals Imported into Ireland from Great Britain and the Isle of Man during the Twelve Months ended 31st December, 1929, was as follows :—

Cattle ...	...	261 Stores. 31 Milch Cows. 8 Springers. 14 Calves.
Sheep ...	...	490 Stores.
Pigs ...	...	9 Stores.
Goats ...	...	7.
Horses ...	...	394 Stallions. 2,526 Mares. 773 Geldings.
Mules ...	...	1.
Asses ...	...	1.

RETURN of the Number of Horses Exported from Ireland through Great Britain to the Colonies and Foreign Countries during the Twelve Months ended 31st December, 1929, showing the Ports of Embarkation in Ireland :—

Ports.	Twelve months ended 31st December, 1929.			
	Stallions.	Mares.	Geldings.	Total.
Belfast	—	39	54	93
Cork	—	10	29	39
Dublin	67	490	457	1,014
Dundalk	—	—	2	2
Greenore	—	292	248	540
Waterford	—	402	324	726
TOTAL	67	1,233	1,114	2,414

There were 3 Stallions, 944 Mares, 776 Geldings, 4 Jennets, and 57 Asses exported from Dublin (direct) to Antwerp, 1 Mare (direct) to Oslo and 1 Gelding (direct) to Baltimore.

IMPORTS of Horses into Ireland from the Colonies and Foreign Countries, either direct or through Great Britain, during the Twelve Months ended 31st December, 1929.

Name of Foreign or Colonial Port at which embarked.	Twelve months ended 31st December, 1929.			
	Stallions.	Mares.	Geldings.	Total.
Boulogne via Folkstone for Belfast ...	1	—	—	1
New York via London for Cork ...	—	—	1	1
Bombay via Liverpool for Dublin ...	2	6	2	10
Calcutta via Liverpool for Dublin ...	—	2	—	2
Calcutta via London for Dublin ...	—	—	1	1
Karachie via Hull for Dublin ...	—	—	1	1
New York via London for Dublin ...	—	5	3	8
New York via Hull for Dublin ...	—	2	7	9
New York (direct) for Dublin ...	4	—	1	5
Montreal (direct) for Dublin ...	1	—	—	1
Boulogne via Folkstone for Dublin	2	19	7	28
Paris via Goole for Dublin ...	20	4	14	38
Dunkirk via London for Dublin ...	—	1	11	12
Antwerp via Harwich for Dublin ...	—	3	3	6
Hook of Holland via Harwich for Dublin	—	—	1	1
Gothenburg via London for Dublin ...	—	—	6	6
Calcutta via Liverpool for Dundalk	—	1	—	1
New York via Fishguard for Waterford	—	—	1	1
Ceylon via Liverpool for Waterford	—	1	1	2
Egypt via Liverpool for Waterford	—	1	—	1
TOTAL	30	45	60	135

DISEASES OF ANIMALS IN IRISH FREE STATE.

The following statement indicates the position with regard to contagious diseases during the Twelve Months ended 31st December, 1929:—

Anthrax outbreaks	2
Foot and Mouth Disease outbreaks	—
Glanders (including Farcy) outbreaks	—
Parasitic Mange outbreaks	28
Rabies outbreaks	—
Sheep Scab outbreaks	186
Swine Fever outbreaks	24
Swine slaughtered as diseased or suspected	362
Tuberculosis outbreaks	2,305
Animals declared affected	2,354

STATISTICAL TABLES.

Quarterly Average Prices for each Province, and for Ireland, of Crops, Live Stock, Meat, Provisions, &c., for the Quarter ended 30th June, 1929.

Product.	Leinster	Munster	Ulster	Connacht	Ireland
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Crops—					
Wheat ... ... per 112 lb.	0 10 6	—	0 12 6	—	0 11 0
Oats (White) ... ,,	0 9 1	0 10 0	0 9 3	0 9 6	0 9 3
,, (Black) ... ,,	0 8 6	0 9 2	0 8 9	—	0 8 7
Barley ... ... ,,	0 8 8	—	—	—	0 8 8
Potatoes ... ... ,,	0 5 6	0 7 6	0 2 11	0 5 3	0 4 7
Hay (1st & 2nd Years' Crop), ton	4 12 3	4 2 0	5 4 9	4 11 9	4 14 6
,, (Meadow) ,,	3 8 0	2 11 3	4 2 3	3 13 3	3 11 0
Grass Seed—					
Perennial per 112 lb.	—	—	0 14 2	—	0 14 2
Italian ,,	—	—	—	—	—
Flax ... ... per 14 lb.	—	—	0 10 9	—	0 10 9
Live Stock— per					
Calves, under 6 months head	3 9 9	2 17 6	3 0 6	4 1 0	3 4 9
Store Cattle—					
6 to 12 months ,,	8 12 0	7 13 9	7 17 3	8 13 0	8 1 9
1 to 2 years ... ,,	12 13 6	11 12 0	11 12 0	12 17 0	12 1 0
2 to 3 years ... ,,	16 12 0	14 16 6	14 19 3	16 7 6	15 14 6
3 years and over ,,	18 16 3	14 15 9c	15 0 0c	18 15 3	17 4 3
Fat Cattle—					
Under 2 years ,,	18 0 0	15 6 6c	—	—	16 0 9
2 to 3 years ... ,,	19 18 3	18 10 6	19 2 9	17 17 0	19 2 9
3 years and over ,,	21 8 3	20 14 6	19 11 9	21 17 9	21 4 3
Cows and Bulls ,,	16 15 3	14 0 0	16 12 0	19 13 6	14 19 3
Springers (Cows and Heifers) ,,	19 14 3	18 7 9	20 0 6	19 7 6	19 9 9
Milch Cows (down Calved) ,,	17 16 6	17 13 9	17 13 0	17 5 9	17 13 9
Lambs, under 12 months ,,	2 2 3	2 5 9	2 0 9	1 14 3	2 2 3
Store Sheep—					
1 to 2 years ... ,,	2 10 6	2 17 3	1 9 3d	2 19 0	2 15 9
2 years and over ,,	2 7 9	1 2 3d	1 16 0d	—	2 3 6
Fat Sheep—					
1 to 2 years ... ,,	3 4 0	3 14 0	2 14 0	3 7 9	3 7 3
2 years and over ,,	3 7 6	3 15 0	2 18 9	4 2 6	3 10 0
Young Pigs, under 12 weeks ,,	1 8 3	1 13 3	2 4 0	1 14 0	1 18 0
Store Pigs—					
12 weeks to 4 months ,,	2 1 3	2 3 3	2 2 6	—	2 2 0
4 months and over ,,	2 14 0	2 19 9	—	—	2 18 3
Meat, Provisions, &c.—	s. d.	s. d.	s. d.	s. d.	s. d.
(a) Beef (Live) ... per 112 lb.	48 6	—	—	—	48 6
,, (Dead) ... ,,	85 0	—	—	—	85 0
(a) Mutton (Live) ,,	63 3	—	—	—	63 3
,, (Dead) ... ,,	110 9	—	—	—	110 9
(b) Pork (Live) ,,	74 6	73 0	76 9	69 6	73 6
,, (Dead) ,,	99 3	97 3	102 3	92 9	98 0
Eggs ... ... per 120	10 10	9 7	9 9	9 5	10 3
Wool ... ... per lb.	1 3	1 2¼	0 11⅜e	1 1⅛	1 2¾

(a) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(b) The live weight price is to the dead weight price in the ratio 3 : 4.

(c) Mostly second class cattle. (d) Mostly Mountain Type.

(e) Mostly Unwashed Mountain Wool.

STATISTICAL TABLES.

QUARTERLY AVERAGE PRICES FOR EACH PROVINCE, AND FOR IRELAND, OF CROPS, LIVE STOCK, MEAT, PROVISIONS, &c., for the Quarter ended 30th September, 1929.

PRODUCT.		Leinster	Munster	Ulster	Connacht	Ireland
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Crops—						
Wheat ...	per 112 lb.	0 10 6	0 9 4	—	—	0 10 5
Oats (White) ...	,,	0 8 0	0 6 11	0 8 2	0 8 7	0 7 6
,, (Black) ...	,,	0 7 4	0 6 1	—	—	0 7 1
Barley	,,	0 7 9	0 7 4	—	—	0 7 6
Potatoes	,,	0 5 8	0 4 6	0 3 6	0 4 5	0 4 4
Hay (1st & 2nd Years' Crop),	ton	4 6 0	3 5 0	4 4 9	3 10 6	3 18 0
,, (Meadow) ...	,,	3 7 9	2 11 3	3 3 3	2 19 3	3 4 3
Grass Seed—						
Perennial	per 112 lb.	—	—	0 14 11	—	0 14 11
Italian ...	,,	—	—	1 1 6	—	1 1 6
Flax ...	per 14 lb.	—	—	—	—	—
Live Stock—	per					
Calves, under 6 months	head	3 7 3	2 14 0	2 12 9	3 13 0	3 0 9
Store Cattle—						
6 to 12 months ...	,,	8 0 3	6 18 3	7 16 6	7 5 0	7 11 6
1 to 2 years ...	,,	11 19 0	10 13 0	11 4 3	11 7 3	11 4 6
2 to 3 years ...	,,	15 16 9	14 2 0	14 1 3	14 9 9	14 16 3
3 years and over ...	,,	18 0 9	16 6 9	15 7 9	18 2 9	17 9 3
Fat Cattle—						
Under 2 years ...	,,	—	14 1 0*c*	—	—	14 1 0
2 to 3 years ...	,,	18 17 6	17 9 3	17 8 6	17 1 3	17 19 0
3 years and over ...	,,	21 1 3	19 15 6	18 4 6	20 12 6	20 12 3
Cows and Bulls ...	,,	15 4 9	13 1 9	14 15 0	18 3 3	13 12 6
Springers (Cows and Heifers)	,,	20 17 0	18 17 9	20 13 0	19 8 3	20 5 6
Milch Cows (down Calved)	,,	18 16 6	17 18 9	18 7 3	17 14 0	18 8 9
Lambs, under 12 months	,,	2 1 3	2 4 3	1 17 6	1 19 6	2 0 6
Store Sheep—						
1 to 2 years ...	,,	2 12 0	2 15 3	1 19 3*d*	3 4 9	2 8 6
2 years and over	,,	2 9 0	1 9 6*d*	2 5 0	2 15 6	2 9 6
Fat Sheep—						
1 to 2 years ...	,,	2 17 6	3 5 9	2 6 9	3 3 9	2 19 3
2 years and over ...	,,	2 17 0	3 4 9	2 8 3	3 1 6	2 17 9
Young Pigs, under 12 weeks	,,	1 8 6	1 14 9	2 5 0	2 0 9	1 19 9
Store Pigs.—						
12 weeks to 4 months	,,	2 0 6	1 19 9	2 7 9	—	2 0 6
4 months and over	,,	2 8 0	3 1 3	—	—	2 18 6
Meat, Provisions, &c.—		s. d.	s. d.	s. d.	s. d.	s. d.
(*a*) Beef (Live)	per 112 lb.	43 0	—	—	—	43 0
,, (Dead) ...	,,	75 3	—	—	—	75 3
(*a*) Mutton (Live) ...	,,	49 9	—	—	—	49 9
,, (Dead) ...	,,	87 0	—	—	—	87 0
(*b*) Pork (Live) ...	,,	67 9	65 6	65 3	62 0	65 9
,, (Dead) ...	,,	90 3	87 3	87 0	82 6	87 6
Eggs	per 120	13 8	13 2	14 7	12 7	13 10
Wool	per lb.	1 1½	1 1¾	0 10⅞*e*	1 2	1 1¼

(*a*) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(*b*) The live weight price is to the dead weight price in the ratio 3 : 4.

(*c*) Second class cattle. (*d*) Mostly Mountain Type.

(*e*) Mostly Unwashed Mountain Wool.

STATISTICAL TABLES.

QUARTERLY AVERAGE PRICES FOR EACH PROVINCE, AND FOR IRELAND, OF CROPS, LIVE STOCK, MEAT, PROVISIONS, &c., for the Quarter ended 31st December, 1929.

PRODUCT.		Leinster	Munster	Ulster	Connacht	Ireland
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Crops—						
Wheat ...	per 112 lb.	0 10 2	0 8 10	0 11 0	—	0 10 1
Oats (White ...	,,	0 6 6	0 6 6	0 6 7	0 7 0	0 6 7
,, (Black) ...	,,	0 5 9	0 5 2	—	—	0 5 6
Barley	,,	0 7 10	0 7 7	—	—	0 7 10
Potatoes ...	,,	0 3 11	0 3 4	0 2 7	0 3 3	0 3 2
Hay (1st & 2nd Years' Crop),	ton	4 9 6	3 15 6	4 0 0	4 1 0	4 2 6
,, (Meadow)	,,	3 3 0	2 13 9	3 1 9	2 18 9	3 1 6
Grass Seed—						
Perennial	per 112 lb.	—	—	0 14 1	—	0 14 1
Italian	,,	—	—	1 5 9	—	1 5 9
Flax ...	per 14 lb.	—	—	0 9 9	—	0 9 9
Live Stock—						
Calves, under 6 months	per head	3 8 6	2 11 0	2 13 0	3 0 0	2 19 6
Store Cattle—						
6 to 12 months ...	,,	7 11 3	6 7 3	7 10 6	7 11 0	7 2 9
1 to 2 years ...	,,	11 10 3	10 17 9	11 4 0	11 13 6	11 4 3
2 to 3 years ...	,,	15 3 9	14 4 3	13 16 9	15 3 6	14 12 9
3 years and over ...	,,	17 13 9	16 6 3	14 12 0	17 16 0	17 4 0
Fat Cattle—						
Under 2 years ...	,,	—	14 2 6c	—	—	14 2 6
2 to 3 years ...	,,	19 14 6	17 4 3	17 5 9	17 9 6	17 19 0
3 years and over ...	,,	22 0 0	18 16 0	17 3 3	20 8 9	20 15 6
Cows and Bulls ...	,,	15 15 6	13 3 6	14 7 9	17 11 0	13 14 0
Springers (Cows and Heifers)	,,	21 0 3	18 11 6	21 8 3	20 0 9	20 11 6
Milch Cows (down Calved)	,,	19 6 3	17 15 9	19 11 3	18 5 3	19 4 0
Lambs, under 12 months	,,	2 4 3	2 8 3	1 16 6	2 1 6	2 3 9
Store Sheep—						
1 to 2 years ...	,,	3 1 6	2 17 0	2 7 9	2 19 6	2 18 6
2 years and over	,,	2 8 3	1 11 3d	2 7 6	3 7 9	2 11 6
Fat Sheep—						
1 to 2 years ...	,,	3 0 3	3 6 3	2 9 9	3 9 9	3 4 9
2 years and over ...	,,	3 0 3	3 4 0	2 8 9	3 13 0	3 2 6
Young Pigs, under 12 weeks	,,	1 15 3	1 12 9	2 8 3	2 7 0	2 3 6
Store Pigs—						
12 weeks to 4 months	,,	2 6 9	2 1 0	3 0 0	—	2 5 0
4 months and over	,,	2 19 6	3 1 0	—	—	3 0 9
Meat, Provisions, &c.—		s. d.	s. d.	s. d.	s. d.	s. d.
(*a*) Beef (Live)	per 112 lb.	42 3	—	—	—	42 3
,, (Dead) ...	,,	74 0	—	—	—	74 0
(*a*) Mutton (Live)	,,	51 0	—	—	—	51 0
,, (Dead)	,,	89 3	—	—	—	89 3
(*b*) Pork (Live) ...	,,	68 0	60 6	60 3	59 3	61 3
,, (Dead) ...	,,	90 9	80 9	80 3	79 0	81 6
Eggs ...	per 120	21 0	21 11	23 0	20 0	21 11
Wool	per lb.	1 1¼	—	0 9⅞e	—	1 1¼

(*a*) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio of 7 : 4.

(*b*) The live weight price is to the dead weight price in the ratio 3 : 4.

(*c*) Second class cattle. (*d*) Mountain Type.

(*e*) Mostly Unwashed Mountain Wool.

OFFICIAL DOCUMENT.

Thirty-sixth list.

AN ROINN TALMHAIOCHTA

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907, SECTIONS 8 AND 14 (1).

List of names approved by the Department for use in connection with Margarine:—

Amonda.

Blue Signet.

Blue Sky.

I. D. L.

Kelven.

Millmar.

Nilcot.

Palette.

Pastel.

Smiling Service.

Sunny South.

Tru-Tresure.

Department of Agriculture,
Dublin, C.17.
31st December, 1929.

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DEPARTMENT OF AGRICULTURE

JOURNAL

Mineral Metabolism in the Pig and the Addition of Inorganic Mineral Supplements to the Pig's Diet—Field Experiments, 1929—Arterial Drainage with some reference to the River Barrow—Seed Propagation, 1929—Plant Breeding, 1928-29—Control of Red Mite on Apple by Winter Spraying—Sugar Beet Experiments, 1929—The Composition of Irish Winter Butter, 1928-29—Saorstát Éireann Mid-Season Fruit Crop Report, 1930—Irish Free State Egg-Laying Competition, 1928-29—Notes and Memoranda—Statistical Tables—Official Document.

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DEPARTMENT OF AGRICULTURE

JOURNAL

VOLUME XXX.

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INDEX—VOLUME XXX.

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MINERAL METABOLISM IN THE PIG AND THE ADDITION OF INORGANIC MINERAL SUPPLEMENTS TO THE PIG'S DIET.

By E. J. Sheehy, F.R.C.Sc.I., B.Sc. *and* B. J. Senior, B.Sc.
Animal Nutrition Department, Albert Agricultural College,
University College, Dublin.

(This paper has already appeared in pamphlet form, having been received for publication in June, 1930.)

INTRODUCTION.

The diet of a fully nourished animal must be abundant in quantity, and in addition its composition must be such that there is no deficiency of any of the variety of ingredients which contribute towards increase in body size or the elaboration of body products. This is of particular importance when early production is desired as in the case of the pig, where the rate of growth is rapid in comparison with that of other farm animals and where growth and fattening take place simultaneously. For the most efficient production, proteins, oils, carbohydrates, water, vitamins and minerals are necessary in more or less definite proportions. The mineral requirements and the conditions necessary for mineral assimilation in the pig have received considerable attention, and a vast amount of information is available in connection therewith. Nevertheless, there are a number of respects in which the literature of the metabolism of minerals by that animal is neither sufficiently accurate nor definite to enable one to make, in the varying circumstances of pig husbandry, definite recommendations regarding the feeding of supplementary minerals.

HISTORY.

The body of the animal contains, in addition to water and organic matter, a variety of salts or mineral substances which are necessary for the maintenance of life and for growth and production. Among the essential elements are calcium, sodium, magnesium, potassium, iron, phosphorus, sulphur, chlorine, and iodine. Some of these enter in considerable quantity into the composition of the body; others, which are equally important for metabolism, accumulate in the system in minute quantity only; and certain elements, such as nickel and cobalt (1)* and copper (2), whose presence cannot be demonstrated in the body, apparently function also in the preservation of life. A complete diet must not alone contain all the necessary inorganic items, but the individual amounts of these substances must bear a more or less definite relation to one another. A good guide in this connection is the mineral composition of milk which

* The numbers in brackets refer to the bibliography at the end of the article.

is the complete natural food for the young growing animal, and which gives results so far scarcely equalled and certainly never excelled by any combination of other foodstuffs. The percentage composition of the ash of milk as compared with that of the newly born animal and with the ash of blood has been determined by Bunge (3) as follows:—

	Potash (K_2O)	Soda (Na_2O)	Lime (CaO)	Magnesia (MgO)	Iron (Fe_2O_3)	Phosphate (P_2O_5)	Chlorine (Cl.)
Dog's milk... ...	10·7	6·1	34·4	1·5	0·14	37·5	12·4
Newly-born puppy	8·5	8·2	35·8	1·6	0·34	39·8	7·3
Dog's blood ...	3·1	45·6	0·9	0·4	9·4	13·2	35·6

Milk contains certain other ash constituents, which however are present only as a trace. The remarkable similarity existing between the mineral content of milk and that of the young animal, and the dissimilarity of both from the ash of blood goes to show that the various minerals are abstracted from the blood in a selective fashion, and secreted in milk in the proportion best suited for the production of growth in the young body. To provide an animal with all of the various mineral ingredients in weighed definite relative quantity would render dietetics very laborious and involved. Fortunately most of the foodstuffs fed to farm animals contain a variety of minerals and the mixing of two or more foods ensures the inclusion of a varied ash content in the diet. While, however, some foodstuffs are complete in mineral content others are deficient in one or more respects, and a combination of foods all of which are deficient in the same ingredient would obviously be unsuited for growth or production or even for the maintenance of life. The minerals which are required in greatest quantity by the body are obviously the most important from the point of view of supply, in connection with which it must be remembered that the different mineral elements serve different functions in the body—insufficiency of one not being compensated for by excess of another.

Table I prepared from a number of sources (4), (5), (6), (7)*, gives the mineral content of some farm foodstuffs.

While the figures on the table representing the individual mineral content of each group of foodstuffs are in themselves instructive more precise and useful information may be gained by considering these in conjunction with the results of feeding experiments on farm animals.

---

* The sources include also the mineral analyses of foodstuffs reported in the present paper.

[TABLE.

Table I.

	Ash or Mineral Composition—per cent.						
	Lime (CaO)	Phosphate (P_2O_5)	Soda (Na_2O)	Chlorine ($Cl.$)	Iron (Fe_2O_3)	Potash (K_2O)	Magnesia (MgO)
Separated milk (liquid)	0·20	0·25	0·08	0·15	0·007	0·21	0·02
Separated milk (dry matter)	2·0	2·5	0·8	1·5	0·07	2·1	0·2
Fish meal	10·0	9·0	Variable		trace	0·05	
Meat (bone) meal ...	Depends on relative proportions of meat and bone.						
Blood meal	0·113	0·53	1·2	0·93		0·41	0·04
Wheat	0·06	0·90	0·15	0·08	0·02	0·53	0·22
Oats	0·14	1·00	0·23	0·07	0·04	0·70	0·35
Barley	0·06	0·80	0·05	0·02	0·02	0·70	0·15
Maize	0·02	0·70	0·04	0·07	0·01	0·40	0·18
Bran	0·19	2·8	0·25	0·09	0·03	1·60	0·75
Pollard	0·15	1·6				0·80	
Linseed cake (or meal)	0·50	2·0	0·34	0·09	0·14	1·30	0·80
Earth nut cake ,,	0·40	1·3				1·50	
Soya bean cake ,,	0·30	1·4	0·60	0·03		1·90	0·40
Palm nut cake ,,	0·30	1·2				0·50	
Potatoes	0·03	0·18		0·04	0·01	0·60	0·03
Swedes	0·08	0·08		0·04	0·007	0·30	
Pasture (†green material)	0·25	0·184	0·061	0·240		0·794	
Pasture (dry matter)	1·004	0·735	0·246	0·950	3·1	3·177	
Hay, rye grass ...	0·58	0·55	0·25			1·45	0·20
Hay, clover	1·60	0·40	0·12	0·25	0·07	1·60	0·45
Straw	0·35	0·25		0·3		1·50	0·10

† Calculated from the dry matter composition on the assumption of 25 per cent. dry matter in fresh green pasture.

Iron.—In the body iron takes part in a number of functions, chief of which is the building up of red blood corpuscles. The store of iron in the body of the newly born young (3) together with the small quantity of iron in milk enables the young animal to effect normal growth during the suckling stage, but if the weaning is delayed and milk is the only food supplied to the young there is grave danger of the development of anæmia with consequent loss. In the young pig rigidly restricted to its mother's milk there is only a narrow margin of safety against anæmia which is likely to develop from the age of 3 to 6 weeks. McGowan and Crichton (8) and (9) have shown that the administration of an iron salt to the bonham prevents the onset of this disease, while Hart and his collaborators (10), (11), (2), (12), have demonstrated that the prevention of anæmia requires both iron and copper salts, or at least an impure salt of iron containing a trace of copper. Both McGowan and Crichton and Hart as well as Rothwell (13) have shown that the administration of iron to the sow does not help to prevent the onset of anæmia in the young. Examination of Table I shows that practically all the foods, other than milk, fed to pigs contain ample supplies of iron; and experience shows that when the little pigs are given supplementary foods at an early age, or are allowed access to the mother's food trough, this condition is very rare indeed especially where the sow has a daily run on pasture. Little bonhams on pasture never develop anæmia because of the supply of iron in the minerals they pick up while rooting in the soil (12). It has been shown also by Hart and his collaborators (12) that in the post-suckling stage there is no danger of nutritional anæmia; while results from Illinois (14) prove that there is no advantage in adding an iron salt to the food of growing pigs which are fed on maize, soya bean meal, linseed meal, alfalfa meal, calcium carbonate and sodium chloride, though the blood of the iron fed group contains more iron than that of the non-iron group. Nevertheless, the composition of the mineral mixture which other investigators continue to use implies the necessity for the inclusion of iron in a mineral supplement. Thus in a co-operative experiment initiated at the Rowett and Cambridge Nutrition Institutes and the Harper Adams College on " Substitutes for fish meal in the ration of fattening pigs " (15), iron oxide was included in the mineral mixture used to supplement cereals, cereal offals and bean meal; and likewise in investigations conducted by Basket on the value of mineral supplements to the breeding sow and porker, (16)) iron oxide was used. No positive proof of the necessity for iron in such circumstances is, however, forthcoming.

Chlorine.—Reference to table I shows that the chlorine content of cereals and cereal by-products and of tubers and roots is low, and since these foods form the major part of the pig's daily ration it would appear advisable to add chlorine in some form to the diet. Forbes and his collaborators (17) state that sodium chlorine is likely to be deficient in pig foods. Evvard et al (18) who have conducted a long series of experiments

on mineral feeding have shown very definitely that a great increase in gain and in the economy of food utilisation results from the addition of common salt to a diet of maize, linseed meal, soya bean meal, cotton seed meal, tankage (slaughterhouse offals) and alfalfa meal. The experience of numerous careful observers confirms these findings as to the value of salt. Apart from the possibility of a deficiency of chlorine in the food, salt is useful as an appetiser, its addition to the diet effecting a marked increase in food consumption. Godden (19) refers to an experiment in which the addition of salt (sodium chloride) to a diet lacking therein caused a marked improvement in the appetite and an increase in the retention of calcium accompanied by the return of the animal to normal health.

Magnesium.—With regard to magnesium there is never any danger of deficiency. In fact table I shows that the cereals and their by-products contain much more magnesia (MgO) than lime (CaO) while in milk the content of magnesia is only one tenth of that of lime. There might therefore appear a possibility of there being an excess of magnesium. Haag and Palmer (20) have observed that in the rat a high intake of magnesium has a depressing effect on the assimilation of calcium, but that a plentiful supply of the latter in the food tends to prevent such an effect. According to Hart, Steenbock and Morrison (21) when dolomite, containing 40 per cent. of magnesium carbonate is added to foods as a source of lime there is normal growth and reproduction in pigs, and carefully conducted experiments by Elmslie and Steenbock on small animals go to show that excess of magnesium does not interfere with the metabolism of calcium unless it is given in such quantity as to cause obvious digestive disturbances and a lowering of the food intake. There is therefore no evidence of injurious effects from the high proportion of magnesia to lime in the foods forming the bulk of the pig's ration.

Potassium.—There would appear to exist an optimum balance between the potassium and sodium content of a diet. Richards, Godden and Husband (22) have brought forward evidence to show that the addition of potassium citrate to a ration of cereals in the case of growing pigs led to decreased retention of nitrogen, phosphates and calcium, and also to a decreased retention of sodium which, however, was definitely temporary in nature. An incorrect impression regarding the effect of the intake of potassium on sodium metabolism which was left by short term experiments conducted by Bunge (3) was thus corrected. There is no evidence however that the proportion of potassium to sodium in cereals and other pig foods is excessive, or that either a deficiency or excess of potassium exists therein.

Iodine.—Of the other inorganic substances not included in table I, sulphur and iodine, more especially the latter, have been the subjects of

much experimental work. In certain parts of the world, notably in regions of the North American Continent, the soil, and the crops, produced thereon, are deficient in iodine, and diseased conditions appear among stock, which may be prevented by the administration of iodine. Brood sows under such conditions give birth to young which are frequently hairless and which show evidence of goitre, many being born dead. The administration of potassium iodide to the mother during gestation prevents the occurrence of these diseased symptoms, (23), (24). Kelly (26), working at the Rowett Institute, found that the addition of potassium iodide to a ration of cereals, blood meal and lime salts raised the retention of nitrogen and phosphates though it had no definite effect on the retention of calcium. Evvard and Culbertson (27) reported a slight increase in the rate of gain and in the economy of food consumption by the administration of iodine to growing pigs. On the other hand Rothwell (28) found no definite positive effects from the feeding of iodine; Crichton (29) who used a basic ration of barley, maize, pollards and skimmed milk determined the effect of added iodine on the number of pigs farrowed and on the rate of growth of young pigs, and obtained negative results; and a recent report from Illinois (14) records still further negative results from the effect of potassium iodide on swine whose basic ration contained cereals and tankage (slaughterhouse offal). Nevertheless the account of certain experiments—such as those reported by Davidson (15) and Basket (16)—in which iodine was included in the mineral mixtures used to supplement a ration of cereals and vegetable proteins, leaves the reader under the impression that there may be some iodine deficiency to fill in the basic ration used.

Sulphur.—The pig, like other animals, assimilates sulphur in complex organic combination principally in the form of cystine (30) which is one of the amino acids found in several of the proteins. The supply of sulphur, therefore, runs parallel with that of the proteins, and where the supply of protein is satisfactory there should be no deficiency of sulphur (17). Evvard and his collaborators (31), (18) made numerous experiments on the value of added sulphur with results which gave no definite indication as to the advisability of supplementing a pig's ration with that element.

Calcium and Phosphorus.—Unlike so many of the other inorganic substances mentioned the lime and phosphate requirement of pigs demand very serious consideration and a large volume of experimental work in this connection is recorded. Reference to Table I. shows that, in comparison with milk, all the cereals and cereal by-products and, to a lesser extent, the cakes and their meals are markedly deficient in lime. They contain, however, an abundance of phosphates thus rendering the phosphate to lime ratio in these foods very high in comparison with that of milk in which the lime content is practically similar to that of phosphate. Both tubers and roots are deficient in lime and prosphates. On the other hand, pasture and other green herbage as well as hay and straw are

rich in both lime and phosphates, and the legumes, such as clovers and lucerne are especially rich in lime which considerably exceeds the phosphate in these plants. Calcium and phosphorus are stored up by the growing animal in more or less equal proportions. Bone, which is the principal storage organ of minerals, contains 36 per cent. of lime (CaO) and 27 per cent. of phosphates (P_2O_5) as may be seen from the following table of analysis

% Composition of Fat-free Dry Bones of Pigs (32)—

Organic matter :	Total ash	Lime : (CaO)	Phosphate : (P_2O_5)	$CaO \div P_2O_5$	Ash ÷ Organic Matter :
34	66	36	27	1·3	1·94

The actual quantity of minerals assimilated during a period of growth may be calculated from the ash composition of the body and the rate of growth. Thus the entire body of the store pig contains about 1% of lime (CaO) and slightly less of phosphate (P_2O_5) (19). Supposing the pig were to make a daily gain of 1½lb. there is added to its body, daily, about ¼oz. of lime and almost ¼oz. of phosphate, but since the assimilation of minerals may be taken as not more than 50 per cent. (19) (33), the actual requirements thus work out at about ½oz. each of lime and phosphate. If these quantities are taken as being even approximately correct it follows that a growing pig, limited to a diet of maize (1-part), barley (1-part) and potatoes (2-parts) would require tc eat about 8 lbs. of food daily in order to assimilate sufficient lime (CaO) for ordinary needs. Such a rate of consumption is not within the capacity of young pigs. Crichton (34) has calculated that on a ration of equal parts of barley, middlings and maize, a sow suckling 10 bonhams would require to eat 150 lbs. of the ration daily in order to replace the outgoing mineral matter in her milk. Oxen, sheep, horses and other herbivorous animals take in large quantities of lime and less of phosphate in the pasture, hay and straw which they consume, and thus in the case of these animals the excess of phosphate ingested with the cereals, roots, etc., is compensated for by the excess of lime over phosphate in the remainder of their diet. The major portion of the food of pigs on the other hand consists of cereals and their by-products which contain large quantities of phosphates, but exhibit a marked insufficiency of lime. Abundant evidence exists of the ill effects of lime deficiency in the food of pigs. Elliot, Crichton and Orr (35) conducted an experiment with two groups of pigs fed on a basic ration of oatmeal, bran, bloodmeal, swedes, potatoes, and cod liver oil, with, in the case of one group, an addition of a mineral mixture rich in lime. The pigs getting the mineral mixture showed normal growth while the group on the basic ration alone " began to show signs of malnutrition within the

first 30 days. There was lack of lustre of the hair, decreased appetite and slower rate of growth. By the end of the second month the animals had become lethargic, and when forced to move, their gait was stiff and stilted." The increase in weight was twice as much in one case as in the other. In an experiment conducted by Sheehy (36) on the value of blood meal as a pig food, a diet of cereals and blood meal induced "cramp," while the same diet supplemented by steamed bone flour resulted in normal health and growth. Shaw (37) found that pigs on barley, pollards and meat meal (containing no minerals) made less gain than a comparable lot which received lime in addition. The group lacking the lime developed lameness and showed a great liking for the lime mortar on the walls which they continuously licked. Davidson (15) reports the development of "crampiness," scurfy skin, and depraved appetite in groups of pigs fed on cereal meals, and also in groups receiving cereal meals and bean meal. Such a condition did not appear when calcium rich minerals were added to the diet. The same writer (38) put forward evidence which showed that deficiency of lime (CaO) was the cause of weak litters of pigs, and resulted in high post-natal mortality, which became successively worse with succeeding generations. No evidence of malnutrition in pigs resulting from a deficiency of phosphorus in cereals or their by-products, similar to that due to a calcium deficiency, is forthcoming, though it is probable that pigs which live largely on potatoes and roots suffer from both calcium and phosphorus deficiency. Evidence of phosphorus deficiency which, in fact, is relieved by the feeding of cereals or their by-products is, however, forthcoming from other sources. In certain pastures of Africa, Australia, and America for instance (39), (40), (41), (42) poverty of phosphorus is responsible for dreadful disease conditions among stock, particularly cattle. The feeding of cereals prevents the development of these conditions, and Huffman and Taylor (43) reported that phosphorus deficiency diseases on Michigan pastures are associated with seasons when little or no grain is fed. Bohstedt, Bethke and Edgington (44) concluded after an extensive series of experiments on the mineral requirements of pigs that "phosphorus appeared not to be primarily lacking in a ration composed of seeds or seed products." The results of the experiments on calcium deficiency above referred to show that calcium given in inorganic form is absorbed and metabolised. It must be borne in mind, however, that portion of the metabolised calcium as well as some of the phosphorus and possibly other mineral elements are excreted from the lower gut and escape with the fæces, so that examination of the fæces alone does not convey any idea as to the absorption of a definite weight of minerals consumed.

While there appears to be no doubt whatsoever as to the utility and the practical significance of adding calcium to a calcium deficient diet, the recent work of Evans (45) proved that the benefit is entirely concerned with the metabolism of minerals rather than with any enhanced effect on the digestibility of the organic constituents of the food.

Calcium to Phosphorus Ratio.—The choice of calcium compound to supply the calcium deficiency of cereals is important. Inorganic calcium is available in the form of calcium phosphate from steamed bone flour, bone charcoal or bone black, and rock phosphate, and it is available as calcium carbonate in precipitated chalk, ground limestone and marl. The use of any of the three last mentioned supplements would not alter the total quantity of phosphorus supplied, while it would tend to bring the calcium up to equality with or perhaps to excess of the phosphorus. The use of a calcium phosphate supplement, however, would increase both the calcium and phosphorus consumed by about equal amounts and consequently would tend to rectify the calcium to phosphorus ratio of the cereals only to a slight degree. Though much experimental work has been done in this connection the issue is still somewhat obscure in view of the absence of complete agreement between the results obtained by different investigators. Hart, Steenbock and Morrison (21) secured normal growth and normal reproduction in pigs on a ration of yellow corn, pollard, oil meal, salts, cod liver oil and marl. Forbes (46) found that when corn, pollards, and linseed cake meal were used as a basic diet the addition of ground limestone, precipitated calcium carbonate, precipitated bone flour, special steamed bone flour, and marl, had the same effect, and he came to the conclusion that the basic ration had sufficient phosphate for maximum growth. The results of Evvard et al (18) indicate that limestone alone is not inferior to other sources of calcium for the purpose of supplementing the basic ration used, nevertheless Evvard who has done very extensive work on mineral supplements, appears to have a partiality for a calcium supplement consisting of equal parts of calcium carbonate (ground limestone) and calcium phosphate (steamed bone flour)—(31), (18), (47). Sheehy (36) found that pigs fed on cereals, bloodmeal and steamed bone flour (*i.e.* calcium phosphate) effected gains of 1¾ lbs. to 2 lbs. per day over an extended period, which showed that steamed bone flour was an efficient mineral supplement to the basic ration used. Evidence from work done on other animals also goes to show that the choice of calcium salts to supplement a predominantly cereal ration makes no difference in the result obtained. Thus some Ohio experiments with different minerals on chicks (48) proved that, when judged by the ash in the bones of the fowl fed thereon, equal amounts of calcium consumed as calcium carbonate, calcium sulphate, calcium lactate, calcium phosphate, oyster shell, high calcium limestone, dolomitic limestone, bone meal, or certain rock phosphates, gave similar results. These findings would suggest a certain independence between calcium and phosphorus metabolism and the work of Evans (49) on the pregnant sow, which showed that phosphate absorption was not proportional to the calcium in the food and that the storage of calcium and phosphorus did not run parallel during gestation, goes to support the same view. It would appear, therefore, that there is a very wide and safe margin of variation in the calcium to phosphorus ratio of the pig's diet, at any rate under optimum conditions of mineral assimila-

tion. The use of rock phosphate which supplies calcium phosphate mixed with impurities as a source of minerals has not been favoured. Hart, Steenbock and Morrison (21) found this mineral less useful than steamed bone flour, and Evvard (50) attributed the poor results from rock phosphate to its high fluorine content.

Vitamin "D" for Mineral Assimilation.—Much of the earlier work on mineral utilisation is necessarily indefinite due to the fact that the importance of the conditions necessary for mineral assimilation, especially for that of calcium and phosphorus, was not fully recognised. The extensive investigation of the vitamins has definitely shown that the maintenance of animal well-being necessitates at least four vitamins namely A, B (1 and 2), C, and D, the last of which is absolutely essential for the utilisation of minerals and for the deposition of calcium and phosphorus in the normal process of bone growth. In the absence of vitamin D the bones of a growing pig become soft due to their excessive content of organic matter, the limb bones bend, the animal goes lame, and shows signs of pain on movement. At the same time the rate of growth slows down and other symptoms of ill-health such as scurfy skin and staring coat are exhibited. Recent work has shown this condition of the pig to be similar in etiology to rickets in the human and other animals. The most potent sources of vitamin D or the anti-rachitic vitamin, as it is now called, are sunlight and liver oils, while green herbage contains a considerable amount of it, and milk and eggs contain some.

Sunlight.—There is abundant evidence of the potency of sunlight for the prevention of the rachitic condition which develops in pigs subsisting on a diet complete in all respects except vitamin D. Zilva, Golding and Drummond (51) reported the production of rickets in pigs kept in the dark and fed on cereals, separated milk and minerals. An experiment conducted at the Rowett Institute (52) showed that the thriftiness and rate of growth in young pigs was less when they were kept in the dark than when reared in a pen where they were exposed to the direct light of the sun. Steenbock et al. (53) compared the progress made by two similar groups of pigs fed on corn, sodium chloride, calcium carbonate and skimmed milk, one group being kept in the dark and the other in the light. The former grew more slowly than the latter, and the individual pigs kept in the dark developed stiffness of gait while their bones showed chemical and histological evidence of poor mineral deposition. Maynard, Goldberg and Miller (54) produced similar effects in pigs fed on maize, middlings (pollards) and linseed meal, while Golding and Morris (55) found that pigs fed on pollard, barley meal, dried separated milk, chalk and animal charcoal developed rickets when light was excluded, but that the animals developed normally when light was admitted to their compartments. Extensive proof of the increased deposition of calcium and phosphorus through the use of artificial irradiation as a substitute for the sun's rays is also on record (56), (57).

Oils.—The influence of oils in the prevention of rickets is less definite, although the use of liver oils as a therapeutic agent in the case of farm animals, including pigs, has been reported very early in relevant literature. Gobley (58), as early as 1844, successfully treated rickets with the oil prepared from the liver of the ray. Schabad (59) and Meyer (60) found that the retention of calcium and phosphorus was increased by the use of cod liver oil. Steenbock, Hart and Jones (61) found that cod liver oil gave positive results both in the prevention and cure of a rickety condition in pigs. Drummond, Zilva and their collaborators (62), (63), (51) demonstrated that the rickety condition was relieved and growth restored by the use of cod liver oil. Golding (64) reports that pigs which were " off their feet " were cured by the addition of $\frac{1}{4}$ to $\frac{1}{2}$ ounce of cod liver oil daily to their diet. Husband, Godden, and Richards (65), however, found that the beneficial results from cod liver oil were due to the oil *per se* rather than to any vitamin property it possessed, and they brought forward evidence which seemed to show that the addition of cod liver oil, linseed oil, and olive oil to a ration of cereals and blood meal produced similar effects in increasing the retention of calcium and phosphorus. Some of the earlier results from the use of cod liver oil were possibly vitiated by the neglect of the effect of light which of course was not definitely known at the time, and also by the confusion of vitamins A and D. Thanks to the advance in vitamin study the effects of vitamin A and D may now be clearly differentiated (66). In the work reported by Husband et al. (65) the pigs may have already received, prior to their being put under test, enough light to provide them with a sufficient store of vitamin D to counteract any possible differentiation between the effects of cod liver oil and the other oils used during the experimental period. Similarly in an experiment conducted by Elliot, Crichton, and Orr (35) where the addition of linseed oil and of cod liver oil to a ration of bran, oats, blood meal and a salt mixture gave similar results, it is possible that the effect of light prevented any possible difference in the oils from becoming evident. The same uncertainty applies in the case of an experiment by Orr and Crichton (67) where similar results were obtained from the use of cod liver and linseed oils, as it is not clear from the report whether the animals had a sufficient supply of vitamin D in their bodies at the start of the experiment to tide them over the experimental period. Likewise Foerster's experiments (68), in which a group of pigs receiving cod liver oil made the same progress as a similar group which got the basic ration only, have little significance unless the pigs were first starved of vitamin D and then kept continuously out of direct light during the period of the experiment.

Green Feeding and Milk.—The diet of the pig frequently includes pasture or other green stuff such as cabbage, rape or marrow stem kale, and the possibility of such food influencing mineral metabolism in this species of animal must be borne in mind. That such green food is a source of vitamin D has been shown by the extensive work of Hart and his collaborators (69), (70), (71) on goats. In fact there is definite evidence that carefully cured hay contains a moderate amount of the anti-rachitic vitamin. Since green

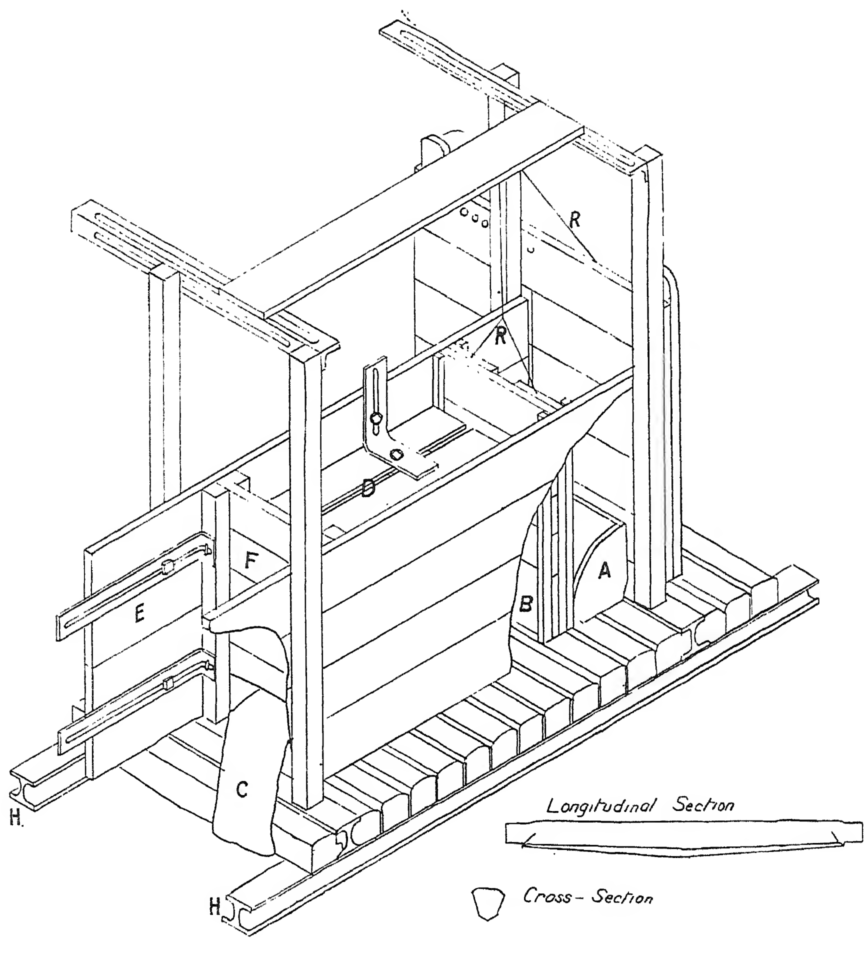
food is assimilable by the pig it is fair to presume that the vitamin D thereof can be utilised by that animal for the purpose of aiding the assimilation of minerals. Practical observation also bears testimony to the efficacy of green feeding to maintain health in pigs kept under adverse conditions. On the other hand the quantity of green food consumed by pigs, especially young pigs, is very limited (72), and it is problematical whether the amount ingested contains sufficient of the anti-rachitic vitamin to supply fully the pig's requirements in that direction. The utility of green food as a source of vitamin D does not however warrant the conclusion that green food is a necessary ingredient of a complete and efficient pig ration. Sheehy (72), the Olympia Agricultural Co. Research Department (73) and Paterson (74) have conclusively shown that when the ration is complete, especially in mineral content, and when the vitamin D factor is otherwise supplied, as in the form of light for instance, then green feeding does not enhance the value of the ration either by increasing the rate of growth or by rendering the utilisation of the food more economical. The potency of milk in vitamin D depends on the vitamin content of the food on which the animals yielding the milk are fed, but in the centrifuging of whole milk the vitamin is skimmed off with the cream so that separated milk, which is a fairly staple food for pigs, contains none of it.

Complementary Relationship between Minerals and Vitamin D.—There is a complementary relationship between the supply of minerals, particularly lime and phosphates in the food, and the available vitamin D whether it be supplied through the medium of light, or in cod liver oil or other form. Thus Bethke, Steenbock, and Nelson (75) showed that when the anti-rachitic vitamin is deficient the trouble caused thereby may be partly rectified by the addition of excess of lime. Henderson (76) demonstrated that in the pig the effect of light was at a minimum when the inorganic materials were supplied in abundance and a proper balance maintained between the calcium, phosphorus and magnesium. Experiments made at Ohio (77) on the pig also gave further evidence of the existence of a wide margin for variation in the proportions of calcium and phosphorus in the ration, but showed that the requirements of the vitamin D factor is least when the calcium to phosphorus ratio varies between 1 : 1 and 2 : 1. It is obvious, however, that while the mineral salts and the vitamin factor necessary for their utilisation may be complementary there is no possibility of one entirely replacing the other in the diet of the pig or of any other animal.

EXPERIMENTAL.

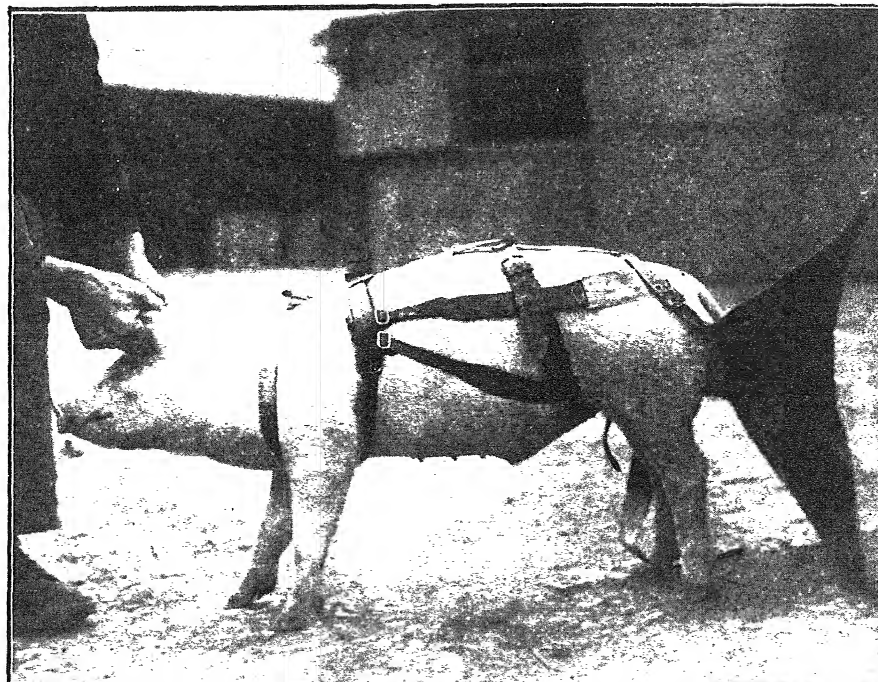
Experiments were begun in the summer of 1928 with a view to testing the accuracy of some of the conclusions in the literature regarding mineral feeding and also to carry the investigation some stages further, with the ultimate object of enabling precise recommendations to be made to practical pig keepers as to the feeding of supplemental minerals and the conditions necessary for their efficient utilisation. A two-fold line of enquiry was followed. Group tests, extending over considerable feeding periods, were

FIGURE 1



Pen constructed for Balance experiments. Portion of the side is cut away to show the feeding trough A and sliding head end B which is operated by the rope RR. C is the cloth suspended from the animal to carry the faeces to a collecting trough, D the lid, E the adjustable side, and F the adjustable and removable rear portion of the pen. The longitudinal and cross sections of one of the beams forming the floor are also shown. The floor is supported 2′ off the ground by HH. There is a hinged door in front of the feeding trough.

Figure 2.



made in the usual way, and, simultaneously, precise balance experiments on animals similar to those in the group tests were carried out where desirable. The balance experiments necessitated the confinement of the pigs in specially made pens so constructed that the pigs could be fed on weighed quantities of food in wasteproof troughs and the urine and faeces could be quantitatively collected. In that way the total intake of mineral material and its excretion in the faeces and urine during the period of the experiment was accurately determined, and the balance, *i.e.*, the retention by, or the loss from, the body calculated.

Housing and Accommodation.—The animals in the group tests were accommodated in pens of suitable size, lighted either directly or through window glass as desired, and provided with adjacent open yards to which access was given or withheld as required. The floors and walls were concreted and no bedding whatsoever was provided. In order, however, to compensate to some extent for the lack of bedding, sleeping quarters were constructed in the form of a wooden platform, raised a few inches off the floor. Some four feet over this a canopy of wood was fitted in cold weather in order to conserve the heat and increase the animals' comfort. It became clear, however, that young pigs so accommodated were not as comfortable or as contented as if they had been bedded with straw or other litter, and the effect of the discomfort was reflected in the comparatively small daily gains made, especially in the winter months.

The pen for balance experiments—an illustration* (Figure 1) of which appears opposite to page 12 was constructed of wood and so made that its capacity could be adjusted to the size of the animal. The amount of space given to the pig was just sufficient to allow him to stand and lie comfortably, but insufficient to allow him to turn round in the pen. The placing of a ring in the nose proved useful in preventing recalcitrant pigs from reversing their position while they were confined during the balance tests.

The floor of the pen was made of planed wooden battens which were impregnated with creosote, and so shaped as to provide, when in position, the greatest possible comfort to the animal and at the same time to direct the flow of urine to the centre of the floor so as to avoid possible loss by overflow. The battens were placed about one quarter of an inch apart transversely across the floor of the pen, which was raised some distance above the floor of the house so as to allow for the collection of the urine from the animal. A large funnel almost the full size of the pen fixed in position beneath the battens collected into an earthenware jar beneath all the liquid which came through from above. The tail end of the pen had cut in it a rectangular hole through which a suitable piece of canvas was slung from the hind quarters of the pig for the purpose of directing the faeces into a trough placed in position. The canvas cloth was suspended from the animal by straps over the body—as shown in the illustration (Figure 2) on opposite page—and was so adjusted that the faeces, when voided, fell directly on to it and rolled away outside the pen into the

* The sketch from which the illustration was made was kindly prepared by F. P. Hussey, B.Agr.Sc.

collecting trough. It is obvious that only male pigs are suitable for work with such apparatus, but there is no evidence of the existence of sexual differentiation, apart from response to pregnancy, in the utilisation of minerals or in the digestion of foods by growing pigs. The head end of the pen was made to slide upwards between wooden strips, and by means of a rope over a pulley in the ceiling the sliding door was raised when necessary to allow the food trough to be pushed into the pen and withdrawn as required. By this arrangement the animal when feeding was prevented from changing his position in the pen and the waste of food which is consequent on movement towards and away from the trough during feeding was thus obviated. While some preliminary trouble occurred, and while disturbing factors did in a few cases arise during the experiments, it may be stated that by careful choice of suitable pigs, a very satisfactory degree of success was achieved in the utilisation of the apparatus for the feeding without waste of the ration provided, and for the separate collection of urine and faeces. Two such pig pens were constructed, and in all experiments a duplicate test was made.

Experimental Material and Procedure: Group Tests.—In the selection of animals for the group tests care was taken to procure litter lots for the equitable division of individuals among the groups. Sex, weight and appearance were also taken into consideration in this connection. In all cases a preliminary feeding period was resorted to so as to ensure the elimination of animals unsuitable for experimental purposes. The pigs were from eight to ten weeks old when the preliminary treatment began, so that the period of the test coincided with a stage of rapid growth and high mineral requirements in the life of the pig. Feeding was done twice daily, the weighed meals being moistened with water, and given in such quantity as the animals readily cleaned up in about an hour after the food was given. In all cases feeding to the limit of appetite as thus judged was practised. Extra drinking water was given as required. The individual animals were weighed weekly throughout the duration of the feeding period, the weighing being done six hours after the morning feed, and a graphical record of progress was made so that the weight history of each animal could be followed. An opportunity was thus afforded of discarding at any time during the progress of the experiment an undesirable animal, or of making an adjustment in the weight curve where, through accident or other cause not arising out of the feeding, the weight of a particular animal on an exceptional occasion deviated widely from the general trend of his weight record. A slight injury, for instance, would on occasion cause an animal either to lose weight or merely to maintain its previous weight for a week, thus placing the group to which it belonged at a disadvantage during that week. During the subsequent week the pig might increase in weight at the same rate as before the accident—curve 1 figure 3, or at such an increased rate as might compensate partly—curve 2 figure 3—or entirely—curve 3 figure 3—for the loss sustained. That a temporary period of sub-normal growth is frequently followed by a period of a much enhanced rate of growth is, of course, well

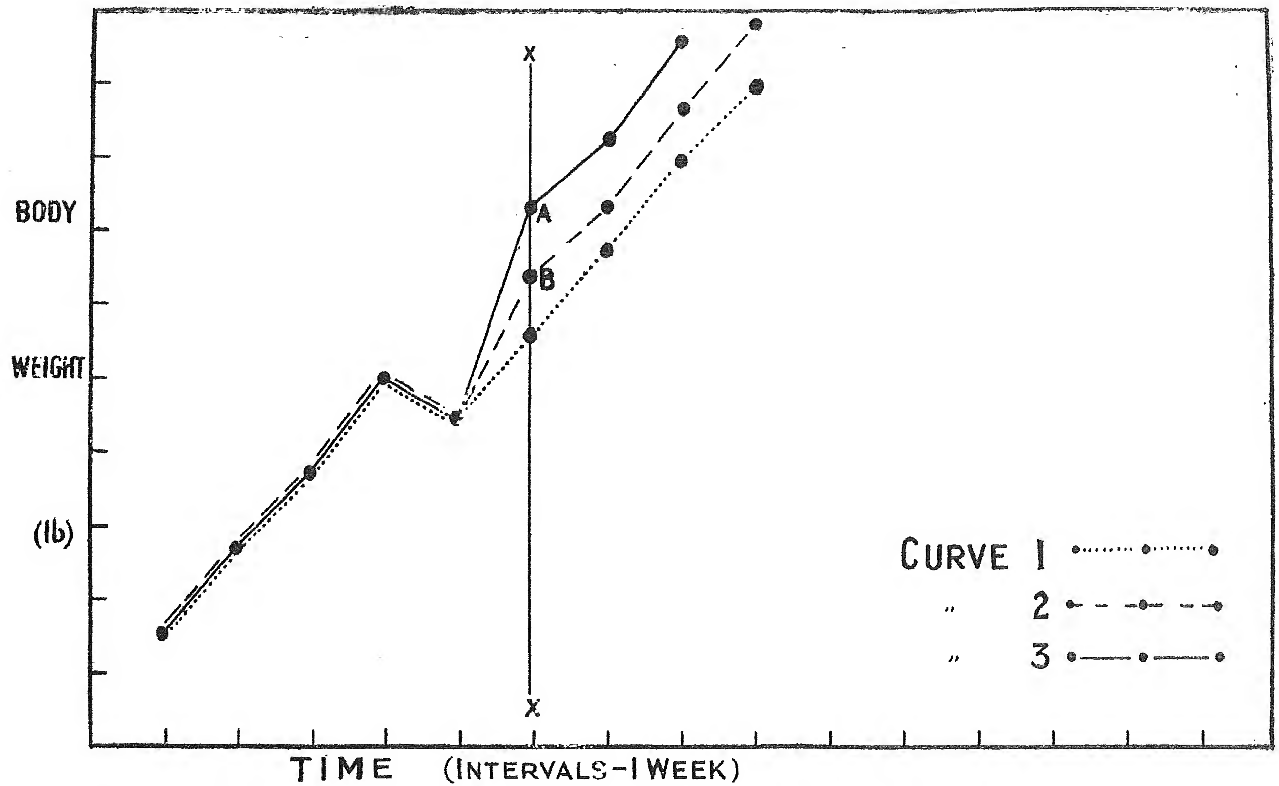


Figure 3.—Curves illustrating the weight record of a pig previous and subsequent to a temporary suspension of progress due to some cause not connected with the feeding. The weight curve subsequent to the interference usually occupies some position between curves 1 and 3. If it occupies the position of curve 2, compensation for the accidental disturbance must be made by the amount represented by the line A B.

known (78). Where, as in the case of curve 3 of figure 3, those portions of the curve previous to and subsequent to the disturbing point form a continuous, more or less straight, line, no compensation should be made for the temporary cessation of progress. Where, however, the rate of growth is represented by either curves 1 or 2 of figure 3 or by a similar curve falling anywhere between curve 1 and curve 3 compensation must, in fairness to the food tested, be made. Such compensation may be effected by adding to the final weight of the pig a sum representing the distance along the vertical line XX between the actual curve of growth and a hypothetical curve 3. If, for instance, the actual curve of growth is represented by curve 2 then the amount to be added to the final weight is that represented by the vertical line AB.

No reference can be discovered in the literature on the subject to this form of correction in the case of group tests; and while it is not claimed that this method will effect any substantial alteration in the final results, yet in the case of accurately conducted tests any means of obviating a possible error, however small, should not be overlooked. It should also be mentioned that the necessity for such an adjustment should not arise too frequently, but nevertheless such accidental disturbances cannot always be prevented even when extreme precautions are taken. The adjusted weights were utilised to compare the rates of progress made by comparable groups, but in the determination of the food cost per pound of body gain the actual final weight figures were used because they represented the actual effect produced by the assimilation of the definite amount of food consumed. The graphical record of the individual weights of the pigs served another necessary purpose, namely, to check the accuracy of the conclusions drawn from the consideration of the initial and final weights of the individual groups. Supposing the average increase in weight made by a group of eight pigs was similar to that of a comparable group on another diet, the value of the foods being compared would be declared similar. The graphical record, however, may reveal that in the first group the rate of growth of the individual pigs was consistently faster than that of the majority of the animals in the other group whose average was raised by an abnormally high rate of progress on the part of one or two exceptionally thrifty animals. In the same way, one or two animals less thrifty than the others in a group may so affect the average final result as to indicate inferiority of that group as a whole to an otherwise comparable group which however contained no unthrifty pigs, whereas in fact no general inferiority actually existed. In all such cases it is necessary to consult the graphical record before drawing conclusions from data collected.

Balance Tests.—The pigs for the balance test were from 11 to 13 weeks old at the beginning of the experimental period. After a preparatory feeding period of five days on the foods to be tested, they were placed in the experimental pen, where, during a further preliminary feeding period of three days, they were fed on the exact quantity of food mixture which they were to receive during the experiment. During those three days the faeces and urine were discarded. The succeeding eight days in the pen constituted the first portion of the experimental period proper, during which time the

faeces and urine were carefully collected, the daily food allowance being exactly similar to that fed during the preliminary period. Each test was performed in duplicate on two more or less similar pigs. At the end of the 8-day period the pigs were released for an interval of five days. Then followed a preliminary period of three days in the pen and a second 8-day experimental period as before. The food mixture to be tested in this second experimental period was fed during the five days' interval as well as during the three days preliminary period; so that the total number of days during which a particular food was supplied previous to the performance of a balance test on it was eight days, as in the previous case. By this means the effects of two different mineral mixtures on the same pigs were compared and in some cases the same animals were utilised for a third determination. The housing of the pigs previous to a balance test, and in the interval or intervals between successive tests, is referred to in the description of the separate experiments.

In the collection of the urine the precaution was taken to wash down the floor of the pen once daily with a measured quantity of rain water. Immediately after the washing the 24 hour collection of urine, together with the wash water, was thoroughly mixed and sampled, one-tenth of the total yield being transferred to a stoppered bottle and preserved. The mixture of urine and water are hereafter referred to in the text as urine. A little chloroform or toluol was added and the bottle kept in a cool place. The mixed sample for the first half of the 8-day experimental period and subsequently the mixed sample for the second half, were separately analysed. The faeces were collected several times each day, and the total daily yield was weighed and preserved in airtight glass jars which were stored in a cool place. At the end of the first half of the 8-day period the faeces from the four days' collection were thoroughly mixed, and samples of a convenient size dried in a steam oven for analysis. The faeces for the second half of the 8-day period were similarly treated, and finally, after the water content had been determined, the two composite samples of dried faeces for the 8-day experimental period were analysed. Though a slight loss of nitrogen and possibly also of carbon (79) may occur by drying in the steam oven it was considered that the figures for calcium and phosphorus content could not be appreciably altered thereby. While in the analysis of the excreta the continuous 8-day period was divided into halves, the entire 8-day period is, for purposes of clarity, treated collectively in the presentation of the data.

The food was given twice daily in the form of a thick porridge, rain water being used to moisten it. Quantities of the foods sufficient for a particular series of experiments were previously placed in suitable containers, and from these the daily rations were weighed out. As the individual foods were being weighed out, daily portions were collected for analysis, and by mixing these a truly representative sample of each individual food was obtained.

The Richards and Godden modification of the Pemberton-Neumann method (80) was used throughout for the estimation of phosphorus, and McCrudden's methods (81) (82) were followed in the case of calcium.

First Series of Experiments: *Complex Mineral Mixtures versus Calcium (lime) Salts.*—Four group experiments were conducted in which a simple mineral mixture of calcium salts was compared with a mineral combination which included other constituents in addition to calcium salts. Each mixture was added to the same basic ration, and in all cases the pigs were housed so that they received abundance of direct light. The basic ration used, the minerals tested, the grouping of the animals, the results obtained showing the individual and collective weights and the gains made, and any relevant observations are outlined below in relation to each individual experiment.

Experiment 1. (*Group Test*).

Duration ... ... 11 weeks.

Basic ration:

Pollard	$3\frac{1}{2}$ parts.
Maize meal	$3\frac{1}{2}$ parts.
Decorticated earth nut meal	1 part.
Common salt	$\frac{1}{2}$ per cent.

Minerals (1). (*Complex mixture*).		Minerals (2). (*Calcium salts*).*	
Precipitated chalk	1 part	Precipitated chalk	1 part
Steamed bone flour	1 ,,	Steamed bone flour	1 ,,
Sulphur (flowers)	$\frac{1}{8}$,,		
Iron oxide (Fe_2O_3)	$\frac{1}{8}$,,		
Potassium iodide	$\frac{1}{125}$,,		
$2\frac{1}{4}$ per cent. of the mixture added to basic ration.		2 per cent. of the mixture added to basic ration.	

Group.	Diet.	No. of Animals.
I.	Basic ration	7
II.	Basic ration + minerals (1) ...	7
III.	Basic ration + minerals (2) ...	7

* The composition of the calcium supplying minerals used in this series of experiments was as follows:—

	% CaO	% P_2O_5
Precipitated Chalk	53.73	—
Steamed bone flour	46.03	35.70
Ground limestone	52.23	—

Table of individual and collective weights and gains, and of food consumption in relation to gain.

Group I.			Group II.			Group III.		
Initial weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial weight (lb.)	Final weight (lb.)	Increase (lb.)
44	131	87	45	153	108	42	155	113
35	95	60	40	142	102	40	166	126
32	91	59	32	135	103	27	107	80
32	99	67	25	104	79	33	125	92
20	73	53	24	98	74	20	92	72
24	59	35	30	98	68	25	92	67
26	58	32	24	99	75	30	95	65
213	606	393	220	829	609	217	832	615
Average increase per pig (weekly) 5·10 lb.			Average increase per pig (weekly) 7·91 lb.			Average increase per pig (weekly) 8·00 lb.		
Food consumed per lb. live-weight increase 3·95 lb.			Food consumed per lb. live-weight increase 3·74 lb.			Food consumed per lb. live-weight increase 3·75 lb.		

The pigs in Group I showed much discontent in their pen and developed a depravity* in appetite as evidenced by the drinking of their own urine, the licking of the concrete walls, the chewing of the wooden sleeping platform, and the disconcerting attention they paid to the boots of the attendant when he entered the pen. It was obvious that they sought something which was lacking in their diet. No more pronounced disease conditions developed, however, and the pigs while not thrifty in appearance looked fairly normal to the eye of the casual observer. It should be noted that the water given to the pigs to drink and used to moisten the food contained lime in solution to the extent of 0.014 parts of calcium oxide per each 100 parts of water, so that the basic diet was actually supplemented by approximately 0.026 per cent. of calcium oxide which would be equivalent to approximately 0.05 per cent. of the ground limestone used in other experiments connected with the investigation. While this small supplement of lime possibly prevented the development of a rickety condition it was obviously insufficient to provide the lime requirements of the growing pig.

The animals in Groups II and III grew normally and appeared similar to one another throughout the experiment.

Experiment 2. (*Group Test*).

Duration ... ... 10 weeks.

Basic ration:

Pollard ... ... 4 parts.
Maize meal ... ... 4 parts.
Bran ... ... 1 part.
Extracted soya bean meal ... ... 1 part.
Common salt ... ... ½ per cent.

* A depraved appetite connected with mineral lack or insufficiency has been noted by quite a number of other investigators (15), (41).

Minerals (1). (*Complex mixture*).		Minerals (2). (*Calcium salts*).	
Ground limestone	1 part	Ground limestone	1 part
Steamed bone flour	1 ,,	Steamed bone flour	1 ,,
Iron oxide	$\frac{1}{8}$,,		
Sulphur	$\frac{1}{8}$,,		
Potassium iodide	$\frac{1}{100}$,,		
$2\frac{1}{4}$ per cent. of the mixture added to the basic ration.		2 per cent. of the mixture added to the basic ration.	

Group.	Diet.	No. of Animals.
I.	Basic ration + minerals (1) ...	8
II.	Basic ration + minerals (2) ...	8

Table of individual and collective weights and gains and of food consumption in relation to gain.

Group I.			Group II.		
Initial weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial weight (lb.)	Final weight (lb.)	Increase (lb.)
59	172	113	62	180	118
52	112	60	53	95	42
55	144	89	68	118	50
51	118	67	55	147	92
50	79	29	46	113	67
37	117	80	37	115	78
39	117	78	41	124	83
36	83	47	32	94	62
379	942	563	394	986	592
Average increase per pig (weekly) 7·04 lb.			Average increase per pig (weekly) 7·40 lb.		
Food consumed per lb. liveweight increase 3·84 lb.			Food consumed per lb. liveweight increase 3·78 lb.		

The pigs in Group II showed a slightly better appetite throughout the experiment than did those in Group I, and the increased progress made by Group II over Group I appeared to be effected entirely by the extra food consumed. The difference in the food cost of each pound of increase in the case of the two groups is not regarded as significant.

EXPERIMENT 3. (*Group Test*).

Duration	... ...	11 weeks.

Basic ration:

Pollard	... ...	4 parts.
Maize meal	... ...	4 parts.
Crushed oats	... ...	$\frac{1}{4}$ part.
Linseed cake meal	... ...	$\frac{3}{4}$ part.
Extracted soya bean meal	... ...	1 part.
Common salt	... ...	$\frac{1}{2}$ per cent.

MINERALS (1). (*Complex mixture*).		MINERALS (2). (*Calcium salts*).	
Precipitated chalk	1 part	Precipitated chalk	1 part
Steamed bone flour	1 ,,	Steamed bone flour	1 ,,
Sulphur	$\frac{1}{8}$,,		
Iron oxide	$\frac{1}{8}$,,		
Potassium nitrate	$\frac{1}{32}$,,		
Potassium iodide	$\frac{1}{128}$,,		
$2\frac{1}{4}$ per cent. of the mineral mixture added to the basic diet.		2 per cent. of the mineral mixture added to the basic diet.	

Group.	Diet.	No. of Animals.
I.	Basic diet + minerals (1)	7
II.	Basic diet + minerals (2)	7

Table of individual and collective weights and gains and of food consumption in relation to gain.

Group I.			Group II.		
Initial weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial weight (lb.)	Final weight (lb.)	Increase (lb.)
24	98	74	29	95	66
25	108	83	29	122	93
34	143	109	32	128	96
34	136	102	23	107	84
25	82	57	23	106	83
18	60	42	23	98	75
22	82	60	23	114	91
182	709	527	182	770	588
Average increase per pig (weekly): 6·84 lb.			Average increase per pig (weekly): 7·64 lb.		
Food consumed per lb. liveweight increase 3·61 lb.			Food consumed per lb. liveweight increase 3·68 lb.		

The individual pigs in Group II showed a more or less uniform rate of increase in live weight, while Group I grew irregularly, some individuals making much more rapid progress than others. The pigs in Group II ate their food with more avidity than those in Group I and they consumed a little more at each meal.

Experiment 4. *(Group Test).*

Duration ... ... 13 weeks.

Basic ration:

Pollard	3 parts.
Barley meal	3 parts.
Wheaten meal	3 parts.
Maize	1 part.
Earth nut meal	1 part.
Common salt	½ per cent.

Minerals (1). *(Complex mixture).*		Minerals (2). *(Calcium salt).*	
Precipitated chalk	1 part	Precipitated chalk	1 part
Steamed bone flour	1 ,,	Steamed bone flour	1 ,,
Sulphur	⅛ ,,		
Iron oxide	⅛ ,,		
Potassium iodide	1/128 ,,		
2¼ per cent. of the mixture added to basic ration.		2 per cent. of the mixture added to basic ration.	

Group.	Diet.	No. of Animals.
I.	Basic diet + minerals (1)	7
II.	Basic diet + minerals (2)	7

Table of individual and collective weights and gains and of food consumption in relation to gain.

Group I.			Group II.		
Initial weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial weight (lb.)	Final weight (lb.)	Increase (lb.)
38	128	90	(35*)	—	—
34	120	86	29	133	104
52	175	123	31	187	156
31	108	77	65	120	55
40	105	65	40	115	75
41	108	67	30	110	80
37	73	36	54	134	80
273	817	544	249	799	550
Average increase per pig (weekly): 6·00 lb.			Average increase per pig (weekly): 7·05 lb.		
Food consumed per lb. liveweight increase 4·17 lb.			Food consumed per lb. liveweight increase 4·00 lb.		

As in the case of Experiments 2 and 3 the animals in Group II of experiment 4 showed a better appetite than those of Group I, though the difference in this respect was less than in the case of the two previous experiments.

Results of Experiments 1, 2, 3, 4.—In the series of tests comprised in experiments 1, 2, 3, and 4 the rate of increase effected by the calcium salts alone was always equal to and in some cases appreciably superior to that made on the complex mineral mixture. Where the rate of growth was greater it was due to increased food consumption. The utilisation of the food was similar in the case of both mineral mixtures fed, that is to say, the food cost per pound of live weight increase was practically the same when a supplement of calcium salts alone was added as when the complex mixture of minerals was used. The results showed that when a

* This pig was withdrawn from the experiment at the third week.

basic diet of cereals and cereal meals, and a vegetable protein together with common salt was fed to pigs in the presence of light no useful purpose was served by adding sulphur, iron oxide and iodine to the ration. That such a basic ration is deficient in calcium was shown by experiment 1 which included a group fed on the basic ration alone. In that group the utilisation of food was poor, and the rate of progress made was comparatively low, and direct evidence of deficiency was given in the form of depraved appetite and unthriftiness.

SECOND SERIES OF EXPERIMENTS. *Comparative effects of Calcium Phosphate and Calcium Carbonate.*—Two group experiments and three balance experiments were conducted in order to compare the efficacy of calcium phosphate, fed in the form of steamed bone flour, with that of calcium carbonate, fed in the form of precipitated chalk and ground limestone, under conditions when both were used as a mineral supplement to a ration of cereals and cereal by-products, blood meal or a vegetable protein, and common salt.

Group Experiments.—The two group experiments namely 5 and 6, were run on more or less similar lines, and each group of pigs received abundant light throughout the duration of the test. The details of each experiment are given below.

EXPERIMENT 5 (*Group Test*).

Duration: 13 weeks, including two weeks on basic diet alone at the beginning of the experiment.

Basic diet:

Pollard	15 parts.
Maize meal	6 parts.
Bran	1 part.
Blood meal	2 parts.
Common salt	½ per cent.

Group.	Diet.	No. of Animals.
I.	Basic diet + steamed bone flour, 2 lb. 6 oz. per each 100 lb. mixture	7
II.	„ + steamed bone flour, 1 lb. „ „ ; precipitated chalk, 1 lb. „ „	7
III.	„ + precipitated chalk, 1 lb. 11¾ oz. „ „	7
IV.	Repetition of group I.	8
V.	Repetition of group II.	8
VI.	Repetition of group III.	8

The supplementary mineral mixture fed to the different groups contained exactly the same amount of calcium oxide (CaO) supplied in different forms. Groups I, II, and III were comparable as regards age, weight, origin, etc., and at the beginning of the test the average weight per pig was 50 lbs. in each group. Groups IV, V and VI were likewise similar and the average weight per pig to start was 38 pounds in each group. The six groups were fed on the basic ration only for 14 days after which time the various mineral supplements were added.

Table of individual and collective weights and gains and of food consumption in relation to gain.

Group I.			Group II.			Group III.		
Initial* weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial* weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial* weight (lb.)	Final weight (lb.)	Increase (lb.)
59	142	83	67	140	73	55	145	90
59	133	74	59	137	78	49	124	75
53	128	75	70	167	97	60	156	96
77	159	82	55	118	63	61	147	86
61	140	79	61	160	99	52	132	80
61	140	79	61	146	85	56	150	94
61	167	106	75	181	106	61	147	86
431	1,009	578	448	1,049	601	394	1,001	607
Average increase per pig (weekly) 7·51 lb.			Average increase per pig (weekly) 7·80 lb.			Average increase per pig (weekly) 7·88 lb.		
Food consumed per lb. live-weight increase 3·63 lb.			Food consumed per lb. live-weight increase 3·37 lb.			Food consumed per lb. live-weight increase 3·27 lb.		

Group IV.			Group V.			Group VI.		
Initial* weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial* weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial* weight (lb.)	Final weight (lb.)	Increase (lb.)
60	119	59	43	117	74	56	127	71
46	126	80	45	120	75	58	174	116
56	149	93	50	140	90	47	121	74
52	111	59	56	138	82	44	130	86
45	121	76	48	125	77	55	127	72
51	143	92	56	108	52	40	115	75
55	105	50	47	150	103	52	127	75
43	126	83	54	156	102	54	151	97
408	1,000	592	399	1,054	655	406	1,072	666
Average increase per pig (weekly) 6·73 lbs.			Average increase per pig (weekly) 7·44 lbs.			Average increase per pig (weekly) 7·57 lbs.		
Food consumed per lb. live-weight increase 4·33 lb.			Food consumed per lb. live-weight increase 3·93 lb.			Food consumed per lb. live-weight increase 3·84 lb.		

* Represents the weight when the mineral supplement was first added to the ration, i.e., after the pigs had been 14 days on the basic ration alone.

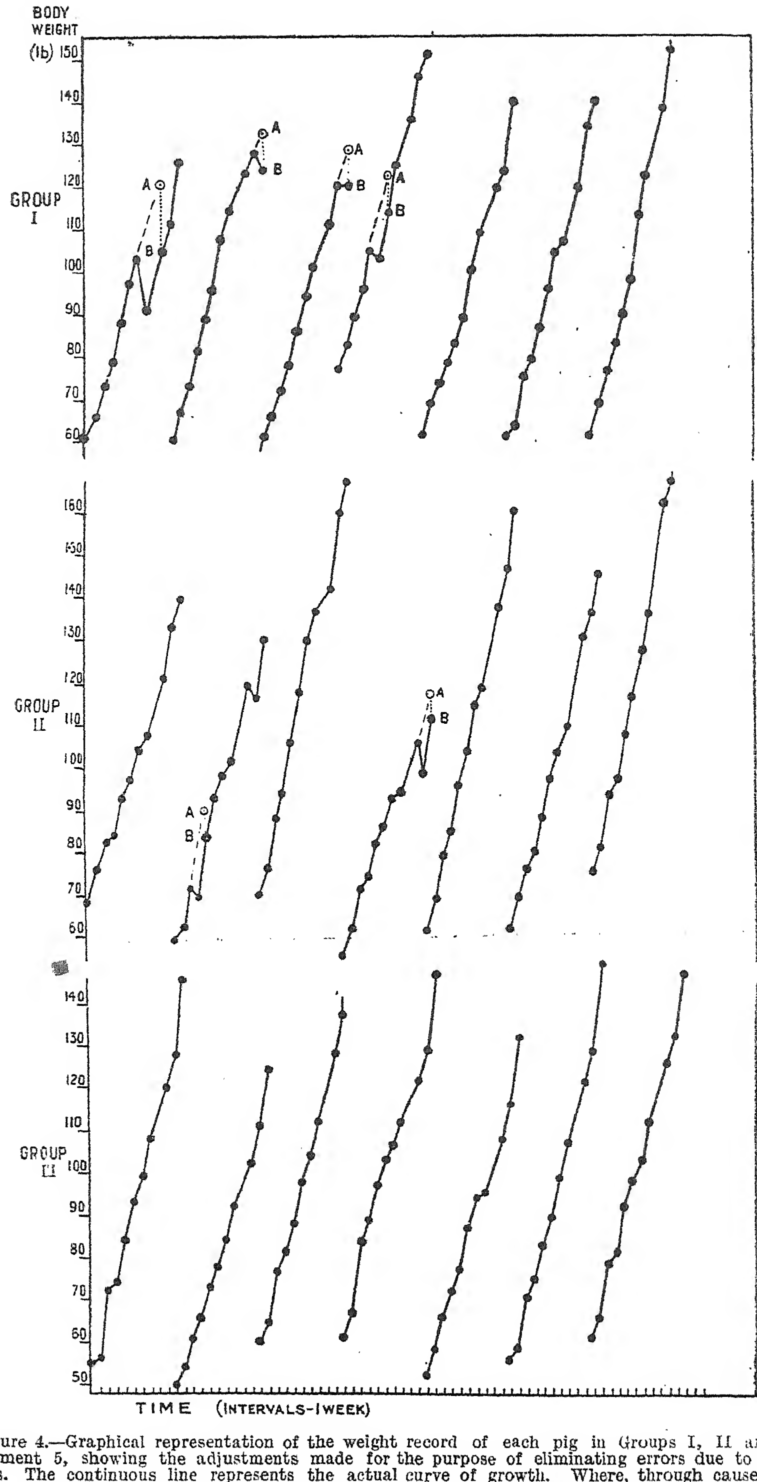


Figure 4.—Graphical representation of the weight record of each pig in Groups I, II and III of experiment 5, showing the adjustments made for the purpose of eliminating errors due to accidental causes. The continuous line represents the actual curve of growth. Where, through causes not connected with the feeding, an animal loses weight or merely maintains itself for a week, a broken line is drawn to represent the curve of growth had not the irregularity occurred. The number of pounds represented by the vertical distance along the dotted line A to B has to be added to the final weight in the case of each pig where such an irregularity occurred, so as to eliminate the effect of accidental losses.

A graphical representation of the results from Groups I, II and III of Experiment 5 is given in Figure 4. These are reproduced to illustrate the adjustments made in the final weights, which are sometimes rendered necessary on account of accidental temporary interference with the rate of progress due to causes not connected with the feeding.

Result of Experiment 5.—In this experiment the three mineral supplements tested proved useful, but the least rapid gains were made when calcium was added in the form of steamed bone flour—Groups I and IV. Where the calcium was supplied entirely in the form of precipitated chalk—Groups III and VI—the rate of gain was greater than where steamed bone flour alone was used, but similar to that where the source of calcium was equal parts of steamed bone flour and precipitated chalk—Groups II and V. In the utilisation of food, that is in the food cost of each unit of gain, there was a similar superiority of Groups II and III over Group I, and of Groups V and VI over Group IV.

EXPERIMENT 6. (*Group Test*).

Duration:

11 weeks including 1 week at the beginning of the experiment when the pigs got the basic diet only.

Basic diet:

Barley meal	3 parts
Pollard	3 ,,
Maize meal	3 ,,
Linseed meal	1 ,,
Rice meal	2 ,,
Blood meal	1 ,,
Common salt	½ per cent.

Group.	Diet.	No. of Animals.
I.	Basic diet + 2% ground limestone ...	7
II.	Basic diet + {1% precipitated chalk, 1% steamed bone flour}	7

The two groups got approximately equivalent quantities of calcium oxide (CaO).

Table of individual and collective weights and gains and of food consumption in relation to gain.

Group I.			Group II.		
Initial* weight (lb.)	Final weight (lb.)	Increase (lb.)	Initial* weight (lb.)	Final weight (lb.)	Increase (lb.)
47	127	80	49	103	54
38	104	66	43	102	59
46	149	103	36	111	75
50	144	94	53	146	93
46	106	60	49	107	58
42	117	75	36	115	79
(41)†	—	—	42	127	85
269	747	478	308	811	503
Average increase per pig (weekly) 7·97 lb.			Average increase per pig (weekly) 7·20 lb.		
Food consumed per lb. liveweight increase 3·4 lb.			Food consumed per lb. liveweight increase 3·6 lb.		

Result of Experiment 6.—As a mineral supplement ground limestone proved somewhat more valuable than a mixture of equal parts of precipitated chalk and steamed bone flour, which supplied the same amount of calcium, but the difference may not be significant. At any rate ground limestone proved definitely not less valuable than the other mineral supplement.

Balance Experiments.—Two balance experiments were conducted for the purpose of comparing the retention of calcium and phosphorus from a basic ration of cereals and cereal by-products, blood meal, a vegetable protein and common salt supplemented by calcium, supplied in one case as a phosphate and in the other as a carbonate. The experiments were carried out in duplicate on pigs of about 12 weeks old. The animals were kept in the light previous to the experiments and also during the interval between the first and second portions of each test. The experiments are numbered 7 and 8.

Experiment 7 (*Balance Test*).—Precipitated chalk was compared with steamed bone flour, both being supplied in such quantity as contained the same amount of calcium oxide. The composition of the basic ration and of the minerals used, the quantity of both fed and the calcium and phosphorus intake, excretion, and balance and other particulars are given below.

* Represents the weight at the end of a week on the basic diet alone.
† This pig was withdrawn from the experiment.

Basic ration:	CaO %	P_2O_5 %
Pollard	.123	1.57
Bran	.103	3.06
Linseed meal	.411	2.39
Flaked maize	.038	.61
Rice meal	.084	4.59
Blood meal	.113	.53
Common salt	—	—
Minerals:		
Steamed bone flour	45.14	32.76
Precipitated chalk	55.68	—

Sequence of experimental periods.

Introductory feeding period (5 days)—Basic ration + steamed bone flour (approximately 2%).

Preliminary feeding period (3 days)—in balance pen—Basic ration + steamed bone flour (approximately 2%).

Balance period 1 (8 days)—in balance pen—Basic ration + steamed bone flour (approximately 2%).

Interval (5 days)—Basic ration + precipitated chalk (approximately 1·6%).

Preliminary feeding period (3 days)—in balance pen—Basic ration + precipitated chalk (approximately 1·6%).

Balance period 2 (8 days)—in balance pen—Basic ration + precipitated chalk (approximately 1·6%).

[TABLES.

Calcium Balance.

		Basic ration consumed daily (grams)	Daily Intake of CaO			Daily Excretion of CaO					Daily retention of CaO (grams)	Retention of CaO per 100 grams consumed
			Food (grams)	Added Minerals (grams)	Total (grams)	Faeces		Urine		Total in faeces and urine (grams)		
						% CaO	Total CaO (grams)	% CaO	Total CaO (grams)			
Pig A.	Balance period 1 ... (steamed bone flour).	804	1·14	7·22	8·36	2·63	5·63	·0038	·063	5·69	2·67	31·94
	Balance period 2 ... (Precipitated chalk).	804	1·14	7·22	8·36	2·65	5·27	·0041	·069	5·34	3·02	36·13
Pig B.	Balance period 1 ... (Steamed bone flour).	804	1·14	7·22	8·36	2·78	5·81	·0045	·074	5·88	2·48	29·67
	Balance period 2 ... (Precipitated chalk).	804	1·14	7·22	8·36	2·75	5·34	·0049	·076	5·42	2·94	35·17

PHOSPHORUS BALANCE.

		Basic ration consumed daily (grams)	Daily Intake of P_2O_5			Daily Excretion of P_2O_5					Daily retention of P_2O_5 (grams)	Retention P_2O_5 per 100 grams consumed
			Food (grams)	Added Minerals (grams)	Total (grams)	Faeces		Urine		Total in faeces and urine (grams)		
						% P_2O_5	Total P_2O_5 (grams)	% P_2O_5	Total P_2O_5 (grams)			
PIG A.	Balance period 1 ... (Steamed bone flour).	804	17·57	5·24	22·81	6·07	12·99	·315	5·26	18·25	4·56	19·99
	Balance period 2 ... (Precipitated chalk).	804	17·57	—	17·57	5·50	10·95	·172	2·90	13·85	3·72	21·17
PIG B.	Balance period 1 ... (Steamed bone flour).	804	17·57	5·24	22·81	6·25	13·06	·334	5·51	18·57	4·24	18·59
	Balance period 2 ... (Precipitated chalk).	804	17·57	—	17·57	5·33	10·34	·164	2·55	12·89	4·68	26·64

EXPERIMENT 8 (*Balance Test*).

In this balance experiment a mixture of equal parts of steamed bone flour and precipitated chalk was compared with precipitated chalk alone and with ground limestone alone, and the retention of calcium and phosphorus from a basic diet supplemented by the different minerals was determined. Particulars of the feeding and the results obtained are outlined below.

			CaO %	P_2O_5 %
Basic ration.				
Maize meal	...	(3 parts)	.027	.79
Pollard	...	(3 parts)	.123	1.57
Bran	...	(2 parts)	.103	3.06
Linseed cake meal	...	(1 part)	.411	2.39
Blood meal	...	(1 part)	.113	.53
Common salt (NaCl)		½ per cent.	—	—
Minerals.				
Steamed bone flour	...	...	45.14	32.76
Precipitated chalk	...	...	55.68	—
Ground limestone	...	...	54.02	—

Sequence of experimental periods.

Introductory feeding period (5 days)—Basic ration + equal parts of steamed bone flour and precipitated chalk (approximately 1% of each).

Preliminary feeding period (3 days)—in balance pen—Basic ration + equal parts of steamed bone flour and precipitated chalk (approximately 1% of each).

Balance period 1 (8 days)—in balance pen—Basic ration + equal parts of steamed bone flour and precipitated chalk (approximately 1% of each).

Interval (5 days)—Basic ration + precipitated chalk (approximately 2%).

Preliminary feeding period (3 days)—in balance pen—Basic ration + precipitated chalk (approximately 2%).

Balance period 2 (8 days)—in balance pen—Basic ration + precipitated chalk (approximately 2%).

Interval (5 days)—Basic ration + ground limestone (approximately 2%).

Preliminary feeding period (3 days)—in balance pen—Basic ration + ground limestone (approximately 2%).

Balance period 3 (8 days)—in balance pen—Basic ration + ground limestone (approximately 2%).

[TABLE.

		Phosphorus Balance									
		Daily Intake of P_2O_5			Daily Excretion of P_2O_5						
	Basic ration consumed daily (grams)	Food (grams)	Added Minerals (grams)	Total (grams)	Faeces % P_2O_5	Faeces Total P_2O_5 (grams)	Urine % P_2O_5	Urine Total P_2O_5 (grams)	Total in faeces and urine (grams)	Daily retention of P_2O_5 (grams)	Retention of P_2O_5 per 100 grams consumed
Pig C. Balance period 1 ... (Steamed bone flour & precipitated chalk.)	1140	18·27	3·67	21·94	3·94	11·70	·201	3·82	15·52	6·42	29·3
Pig C. Balance period 2 ... (Precipitated chalk).	1286	20·62	—	20·62	3·31	9·50	·131	2·61	12·11	8·51	41·3
Pig C. Balance period 3 ... (Ground limestone).	1286	20·62	—	20·62	3·58	10·38	·127	2·70	13·08	7·54	36·6
Pig D. Balance period 1 ... (Steamed bone flour & precipitated chalk).	1140	18·27	3·67	21·94	4·13	13·05	·144	3·04	16·09	5·85	26·7
Pig D. Balance period 2 ... (Precipitated chalk).	1286	20·62	—	20·62	3·80	11·63	·061	1·27	12·90	7·72	37·4
Pig D. Balance period 3 ... (Ground limestone).	1286	20·62	—	20·62	3·64	10·41	·100	2·08	12·49	8·13	39·4

CALCIUM BALANCE

		Basic ration consumed daily (grams)	Daily Intake of CaO			Daily Excretion of CaO					Daily retention of CaO (grams)	Retention of CaO per 100 grams consumed
			Food (grams)	Added Minerals (grams)	Total (grams)	Faeces		Urine		Total in urine and faeces (grams)		
						% CaO	Total CaO (grams)	% CaO	Total CaO (grams)			
Pig C.	Balance period 1 ... (Steamed bone flour & precipitated chalk).	1140	1·34	11·30	12·64	2·43	7·22	·0031	·059	7·28	5·36	42·4
	Balance period 2 ... (Precipitated chalk).	1286·0	1·51	11·58	13·09	1·98	5·68	·0035	·070	5·75	7·34	56·1
	Balance period 3 ... (Ground limestone).	1286·0	1·51	11·56	13·07	2·39	6·93	·0035	·074	7·00	6·07	46·4
Pig D.	Balance period 1 ... (Steamed bone flour & precipitated chalk).	1140·	1·34	11·30	12·64	2·26	7·14	·0032	·068	7·21	5·43	42·9
	Balance period 2 ... (Precipitated chalk).	1286	1·51	11·58	13·09	2·16	6·61	·0041	·086	6·70	6·39	48·8
	Balance period 3 ... (Ground limestone).	1286	1·51	11·56	13·07	2·17	6·21	·0035	·072	6·28	6·79	52·0

Results of Experiments 7 and 8.

The figures for calcium retention in the two experiments and in the case of both pigs show that the utilisation by the pig of calcium phosphate and calcium carbonate is approximately similar. In all cases retention was higher from the carbonate but the difference in its favour is not regarded as significant. As a source of calcium, ground limestone is similar in efficacy to precipitated chalk and both are at least as efficient as steamed bone flour when fed in quantity containing the same amount of lime. The figures for phosphorus are equally consistent, and indicate that the absorption of phosphorus from the total ration was at least as great when the mineral supplement was precipitated chalk or ground limestone as when it was composed of steamed bone flour.

THIRD SERIES OF EXPERIMENTS: *Different Levels of Calcium in a Mineral Supplement.*—Only one experiment was conducted in this connection. A suitable basic ration was supplemented in the one case with 2 per cent. of ground limestone (52.23% CaO) and in the other with 3 per cent. of the same material. The particulars of the trial and the results are as follows:—

EXPERIMENT 10 (*Group Test*).

Duration ... ... 11 weeks.

Basic diet:

Maize meal	... ...	2 parts.
Barley meal	... ...	3 parts.
Pollard	... ...	3 parts.
Rice meal	... ...	1 part.
Blood meal	... ...	1 part.
Common salt	... ...	½ per cent.

Group.	Diet.	No. of Animals.
I.	Basic diet + 2% ground limestone	7
II.	„ + 3% „ „	7
III.	Repetition of Group I.	7
IV.	„ „ „ II.	7

Table of average weights and gains and of food consumption in relation to gain.

Group.	Average Individual			Food consumed per lb. liveweight increase lb.
	Initial weight (lb.)	Final weight (lb.)	Increase per week (lb.)	
I.	50	144·02	8·55	3·80
II.	49	140·42	8·32	3·72
III.	48	141·11	8·47	3·71
IV.	49	143·61	8·60	3·78

Result of Experiment 10.

There was no difference in the rate of gain nor in the economy of food utilisation between the groups receiving a mineral supplement of 2 per cent. ground limestone and a similar supplement fed to the extent of 3 per cent. No difference in the health of the animals in the four groups became apparent.

Fourth Series of Experiments: *The Relation of Direct Light to Mineral Utilisation.*—It is well known that the utilisation of minerals is aided by sunlight, and that in the absence of light, or of some other source of the potent factor in sunlight, a train of disease symptoms appears which have been proved to be associated with the non-assimilation of mineral material. In addition, there is strong evidence that, within limits, light and a mineral supply are supplementary to one another, an insufficiency of one being, at least to some extent, compensated for by an abundance of the other. Two points of importance in connection with this aspect of mineral metabolism suggested themselves for investigation, namely, firstly, the relative effects of light in the absence of minerals and of minerals in the absence of light—Experiment 11; and secondly, the retention of minerals under practical conditions of pig keeping in winter when the available sunlight is at its minimum—Experiments 12 and 13.

Experiment 11. (*Group Test*).

Three groups of pigs were used in this experiment and fed on a basic diet of—

Pollard	$3\frac{1}{2}$ parts
Maize meal	$3\frac{1}{2}$,,
Decorticated earth nut meal	1 ,,
Linseed oil	1 per cent.
Common salt (NaCl)	$\frac{1}{2}$,,

They were fed and accommodated as follows:—

Group I. ...	Basic diet plus $2\frac{1}{4}\%$ of mineral mixture.	Housed so as to receive abundance of sunlight.
Group II. ...	Basic diet only ...	Housed so as to receive abundance of sunlight.
Group III....	Basic diet plus $2\frac{1}{4}\%$ of mineral mixture.	Housed so that the light reached the pigs through window glass on a large roof light—No direct light admitted into chamber.

The mineral mixture used was—

Precipitated chalk	1 part
Steamed bone flour	1 ,,
Sulphur	$\frac{1}{8}$,,
Iron oxide	$\frac{1}{8}$,,
Potassium iodide	$\frac{1}{128}$,,

The actual weight of the individual pigs in each group at the beginning and throughout the experiment is shown in Figure 5.

Result of Experiment 11.

It will be seen that Group I made normal progress. Group II grew much less rapidly and the rate of growth became decreasingly less as the period advanced, and at the termination of the experiment the weight, as judged by the flattening of the curves, seemed to have practically reached its maximum under the conditions. Group I pigs, on the other hand, were still effecting substantial gains when the experiment terminated. The pigs in Group II showed evidence of a distinct want in the diet, the appetite becoming depraved as in the case of the pigs in Group I of Experiment I. As in the case of that group the onset of rickets was delayed to some extent by the lime in the drinking water, which made an addition to the diet of an equivalent of 0.05 per cent. of ground limestone. This was, however, entirely insufficient towards providing the complete lime requirements of the growing pig. The animals in Group III grew and increased in weight rather like the other two groups for a period of about four or five weeks. Then they began to develop an unhealthy appearance, and stiffness in movement became evident. At the same time the rate of increase in weight

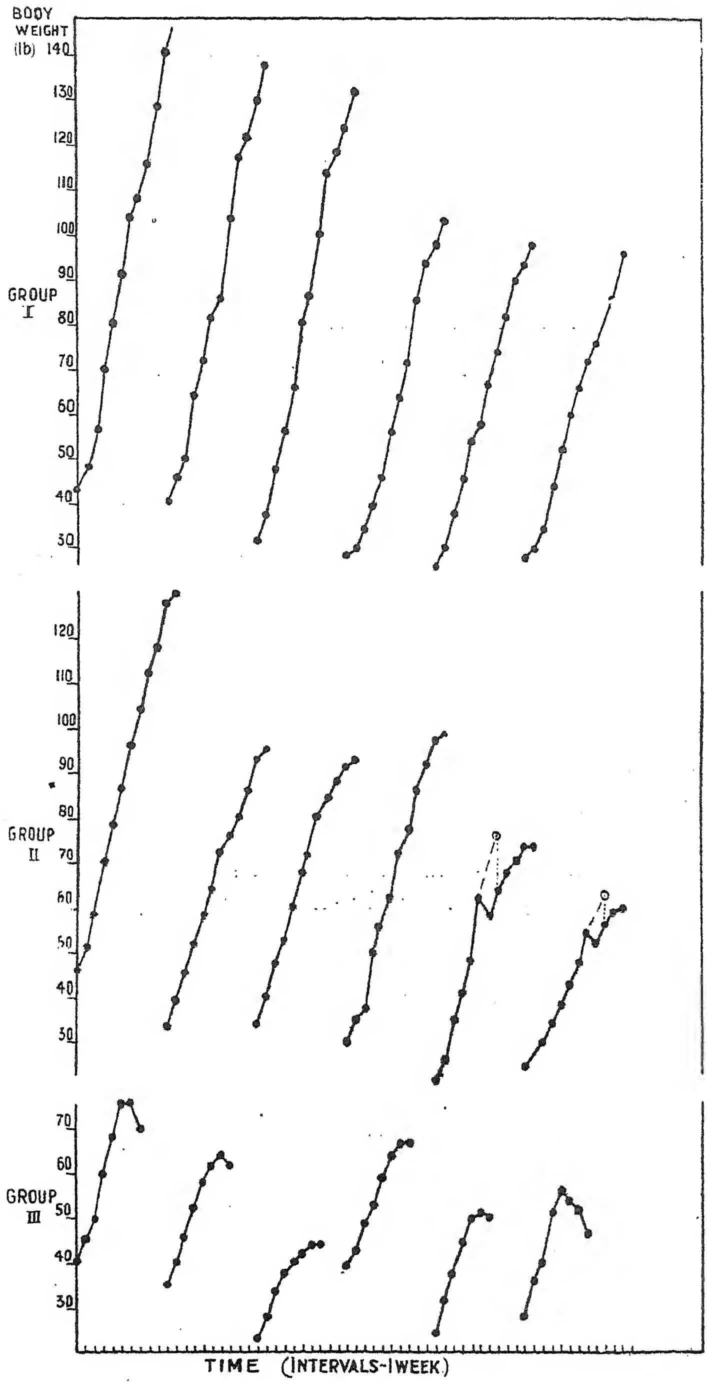


Figure 5.—Diagram showing a graphical record of the individual weights of the pigs in each group in experiment 11. The large dots represent the actual weights of the animals. Note that adjustments (broken and dotted lines) to compensate for accidental disturbances—see figure 3—are made in the case of two pigs in Group II.

Figure 6.

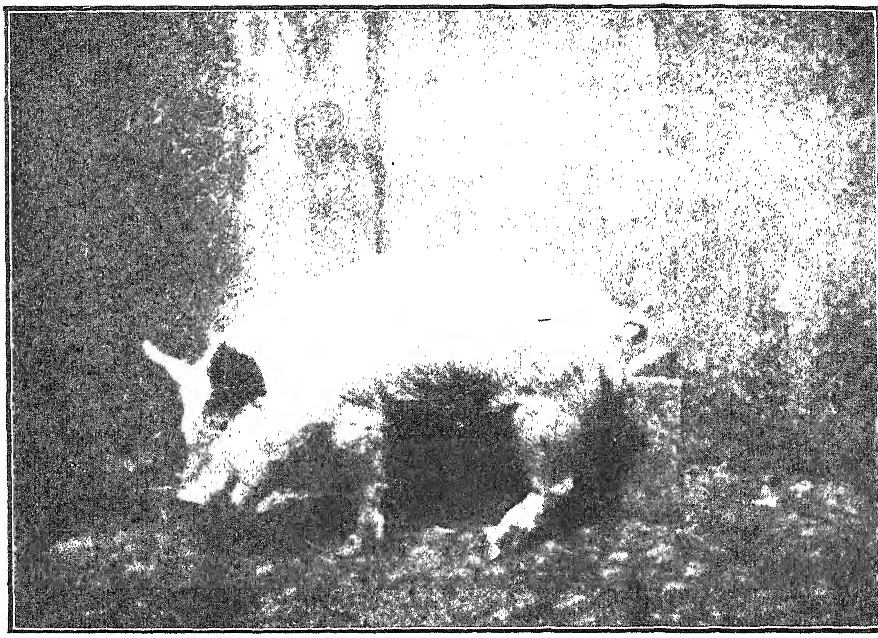
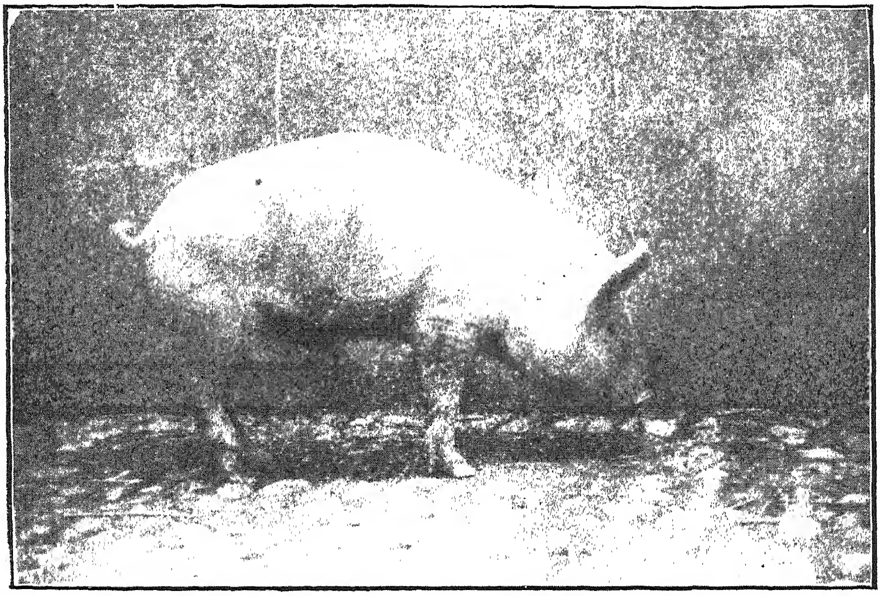


Figure 7.



slowed down, till by the end of seven weeks there appeared no further object in weighing on account of the increase in disease condition. Cramp began to show in some individuals in six weeks, and developed in the others later. In accompaniment with that condition the long bones of the limbs became bent and in some cases lumpy swellings developed in the legs. The pigs lay in their pen till they were forced up; they then got on to their feet with evidence of much pain, and after some time the difficulty of rising overcame their anxiety for food and they remained recumbent continuously. The illustration—Figure 6—gives an idea of the appearance of the animal and especially of the limbs in fairly extreme cases of this rickety condition, while Figure 7 illustrates an earlier stage of the disorder. A marked feature was a scurfy skin, which in some cases became much exaggerated and gave the impression of a dirty oil smear over the surface of the body. Even more interesting was the onset of convulsions in this group, which was first noticed in the seventh week of the experiment. A pig suddenly developed a tremor which rapidly intensified, the animal arching his back and progressing backwards until impeded by some obstacle. In some cases the pig squealed as if suffering from intense pain, and after the lapse of from three to five minutes it fell prostrate, to recover gradually in from about seven to ten minutes after the onset of the attack. Three pigs out of the group succumbed to successive attacks of these convulsive fits. Post mortem examination* of these animals showed no abnormality except enteritis of the jejenum and ileum, but the blood congestion did not appear very serious and was spotted rather than continuous. Another point perhaps worth noting was that in the case of two of the pigs in the group, the cornea became opaque but blindness did not supervene. When the survivors were allowed out into sunlight the " fits " no longer appeared, the appearance of the skin improved, the animals gradually recovered from the lameness but, of course, the limbs remained bent. When increased food consumption took place on recovery a " pot bellied " condition—illustration Figure 8—was produced, and the subsequent progress towards butcher conditions was very disappointing.

Experiments 12 and 13. *Balance Tests. Potency of Winter Sunlight.*—Two successive balance experiments were conducted on different pigs to determine the utilisation of added minerals in the case of pigs which were kept under ordinary winter conditions in a house to which a moderate amount of direct light had access but where no open yard was available for the pigs to run in. The animals were kept under these conditions for a considerable time prior to the start of the experiment and also during the interval between the first and second portion of the trial. The particulars and results of both experiments are given hereunder.

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* The post-mortem examination was very kindly conducted by Professor Craig, M.A., M.R.C.V.S., of the Veterinary College, Dublin.

EXPERIMENT 12. (*Balance Test*).

Basic ration.			CaO %	P_2O_5 %
Cooked flake maize	...	(3 parts)	.029	.545
Maize meal ...	...	(3 parts)	.020	.713
Pollard ...	...	(3 parts)	1.140	1.624
Earth nut meal (decorticated)		(1 part)	.345	1.114
Linseed cake meal	...	(½ part)	.421	2.047
Common salt	...	½ per cent.	—	—

Minerals.				
Steamed bone flour	...	equal parts	46.03	35.70
Precipitated chalk	...		53.73	—

Sequence of experimental periods.

Introductory feeding period (5 days)—Basic ration.
Preliminary feeding period (3 days)—in balance pen—Basic ration.
Balance period 1 (8 days)—in balance pen—Basic ration.

Interval (5 days)—Basic ration + minerals.
Preliminary feeding period (3 days)—in balance pen—Basic ration + minerals.
Balance period 2 (8 days)—in balance pen—Basic ration + minerals.

[TABLE

CALCIUM BALANCE.

		Basic ration consumed daily (grams)	Daily Intake of CaO: Food (grams)	Daily Intake of CaO: Added Minerals (grams)	Daily Intake of CaO: Total (grams)	Daily Excretion of CaO: Faeces: % CaO	Daily Excretion of CaO: Faeces: Total CaO (grams)	Daily Excretion of CaO: Urine: % CaO	Daily Excretion of CaO: Urine: Total CaO (grams)	Daily Excretion of CaO: Total in faeces and urine (grams)	Daily retention of CaO (grams)	Retention of CaO per 100 grams consumed
PIG E.	Balance period 1 (Basic ration). ...	1196	1·27	—	1·27	·75	1·15	·0018	·026	1·18	0·09	7·09
	Balance period 2 (Basic ration and minerals). ...	1196	1·27	11·18	12·45	4·18	7·69	·0029	·052	7·74	4·71	37·84
PIG F.	Balance period 1 (Basic ration). ...	1196	1·27	—	1·27	·92	1·57	·0038	·064	1·63	—0·37	—
	Balance period 2 (Basic ration and minerals). ...	1196	1·27	11·18	12·45	3·70	7·66	·0101	·196	7·86	4·59	36·87

PHOSPHORUS BALANCE.

		Daily Intake of P_2O_5			Daily Excretion of P_2O_5					Daily retention of P_2O_5 (grams)	Retention of P_2O_5 per 100 grams consumed
	Basic ration consumed daily (grams)	Food (grams)	Added Minerals (grams)	Total (grams)	Faeces % P_2O_5	Faeces Total P_2O_5 (grams)	Urine % P_2O_5	Urine Total P_2O_5 (grams)	Total in faeces and urine (grams)		
PIG E. Balance period 1 ... (Basic ration).	1196	12·23	—	12·23	4·14	6·37	·205	2·95	9·32	2·91	23·80
PIG E. Balance period 2 ... (Basic ration and minerals).	1196	12·23	4·00	16·23	5·30	9·76	·097	1·72	11·48	4·75	29·27
PIG F. Balance period 1 ... (Basic ration).	1196	12·23	—	12·23	3·78	6·44	·243	4·09	10·53	1·69	13·82
PIG F. Balance period 2 ... (Basic ration and minerals).	1196	12·23	4·00	16·23	5·11	10·57	·161	3·13	13·70	2·53	15·59

Experiment 13 (*Balance Test*).

Basic ration.

Cooked flake maize	3 parts.
Maize meal	3 parts.
Pollard	3 parts.
Earth nut meal (decorticated)	1 part.
Linseed cake meal	1 part.
Common salt	½ per cent.

Minerals and sequence of experimental periods similar to Experiment 12.

Calcium Balance

		Basic ration consumed daily (grams)	Daily Intake of CaO: Food (grams)	Daily Intake of CaO: Added Minerals (grams)	Daily Intake of CaO: Total (grams)	Daily Excretion of CaO: Faeces % CaO	Daily Excretion of CaO: Faeces Total CaO (grams)	Daily Excretion of CaO: Urine % CaO	Daily Excretion of CaO: Urine Total CaO (grams)	Daily Excretion of CaO: Total in faeces and urine (grams)	Daily retention of CaO (grams)	Retention of CaO per 100 grams consumed
Pig G.	Balance period 1 (Basic ration). ...	941·4	1·13	—	1·13	·99	1·52	·0025	·038	1·56	—0·43	—
	Balance period 2 (Basic ration and minerals). ...	941·4	1·13	11·18	12·31	4·78	8·01	·0011	·015	8·03	4·28	34·77
Pig H.	Balance period 1 (Basic ration). ...	941·4	1·13	—	1·13	1·21	1·92	·0038	·060	1·98	—0·85	—
	Balance period 2 (Basic ration and minerals). ...	941·4	1·13	11·18	12·31	4·49	8·45	·0020	·029	8·48	3·83	31·12

		Phosphorus Balance										
		Daily Intake of P_2O_5			Daily Excretion of P_2O_5							
					Faeces		Urine					
	Basic ration consumed daily (grams)	Food (grams)	Added Minerals (grams)	Total (grams)	% P_2O_5	Total P_2O_5 (grams)	% P_2O_5	Total P_2O_5 (grams)	Total in faeces and urine (grams)	Daily retention of P_2O_5 (grams)	Retention of P_2O_5 per 100 grams consumed
Pig G. Balance period 1 (Basic ration). ...	941·4	10·05	—	10·05	3·43	5·27	·125	1·91	7·18	2·87	28·56
Pig G. Balance period 2 (Basic ration and minerals). ...	941·4	10·05	4·00	14·05	4·78	8·02	·049	·66	8·68	5·37	38·23
Pig H. Balance period 1 (Basic ration). ...	941·4	10·05	—	10·05	3·71	5·90	·172	2·67	8·57	1·48	14·73
Pig H. Balance period 2 (Basic ration and minerals). ...	941·4	10·05	4·00	14·05	4·56	8·58	·063	·92	9·50	4·55	32·39

Results of Experiments 12 *and* 13.

Under the influence of the moderate amount of winter sunlight which obtained in the case of these experiments the four pigs used showed a retention of added calcium which, while not quite so good as in a number of other experiments previously reported in which a flood of light was available, was nevertheless quite considerable.

FIFTH SERIES OF EXPERIMENTS. *Cod Liver Oil versus Linseed Oil as an aid to Mineral Utilisation, and the Practical Value of Commercial Cod Liver Oil.*—Two balance experiments were conducted for the purpose of comparing the potency of cod liver oil and linseed oil. The particular brand of cod liver oil (X) used was described as a commercial high grade cod liver oil. It had been previously assayed (the assay was very kindly performed by Dr. K. Coward of the Pharmacological Laboratory, London, who assigned the sample 100 units of antirachitic vitamin per gram, which is about average for good cod liver oils) and found to contain a high concentration of Vitamin D, *i.e.* the antirachitic factor which is necessary for the normal deposition of lime salts in the bone and for the prevention of the train of disorders associated with rickets and described in connection with experiment 11, Group III. Sunlight and liver oils are both very potent sources of the vitamin D. Subsequently a second sample of cod liver oil (Y) which was given the same description as sample (X) was tested in a group experiment against the same brand of linseed oil used in the balance tests. This second sample of cod liver oil was not assayed by Dr. Coward, but it will be understood that the test applied to it in experiment 16 was comparable, though not similar, with the biological test, applied in the assay of cod liver oil sample (X).

Balance Experiments: The conditions of the two balance tests were similar, except that pigs from the " dark " were used in one case and pigs from the " light " in the other.

EXPERIMENT 14 (*Balance Tests*).

The pigs utilised in this experiment received direct light—Winter sunlight—previous to the experiment and during the intervals between the experimental periods. The retention of calcium and phosphorus was determined first on a complete diet including added minerals without oil, then on the same diet with linseed oil added, and ultimately on the same diet together with cod liver (X) in quantity equivalent to that of the linseed oil already used. The particulars and results are given below.

Basic ration.		CaO %	P_2O_5 %
Cooked flake maize ...	(3 parts)	.029	.545
Maize meal ...	(3 parts)	.020	.713
Pollard ...	(3 parts)	.140	1.624
Earth nut meal (decorticated)	(1 part)	.345	1.114
Linseed cake meal ...	(1 part)	.421	2.047
Common salt ...	½ per cent.	—	—
Steamed bone flour	1 per cent.	46.03	35.7
Precipitated chalk	1 per cent.	53.73	—

Sequence of experimental periods.

Introductory feeding period (5 days)—Basic ration (including minerals).

Preliminary feeding period (3 days)—in balance pen—Basic ration (including minerals).

Balance period 1 (8 days)—in balance pen—Basic ration (including minerals).

Interval (5 days)—Basic ration (including minerals) + linseed oil (1 oz. daily).

Preliminary feeding period (3 days)—in balance pen—Basic ration (including minerals) + linseed oil (1 oz. daily).

Balance period 2 (8 days)—in balance pen—Basic ration (including minerals) + linseed oil (1 oz. daily).

Interval (5 days)—Basic ration (including minerals) + cod liver oil (1 oz. daily).

Preliminary feeding period (3 days)—in balance pen—Basic ration (including minerals) + cod liver oil (1 oz. daily).

Balance period 3 (8 days)—in balance pen—Basic ration (including minerals) + cod liver oil (1 oz. daily).

[TABLES

		Calcium Balance.									
		Daily Intake of CaO			Daily Excretion of CaO						
					Faeces		Urine				
	Basic ration consumed daily (grams)	Food (grams)	Added Minerals (grams)	Total (grams)	% CaO	Total CaO (grams)	% CaO	Total CaO (grams)	Total in faeces and urine (grams)	Daily retention of CaO (grams)	Retention of CaO per 100 grams consumed
Pig G. Balance period 1 (No oil). ...	941·4	1·13	11·18	12·31	4·78	8·01	·0011	·015	8·03	4·28	34·77
Pig G. Balance period 2 (Linseed oil). ...	1175·4	1·42	11·18	12·60	3·49	6·52	·0020	·045	6·57	6·03	47·89
Pig G. Balance period 3 (Cod liver oil). ...	1175·4	1·42	11·18	12·60	3·44	6·43	·0102	·210	6·64	5·96	47·30
Pig H. Balance period 1 (No oil). ...	941·4	1·13	11·18	12·31	4·49	8·45	·0020	·029	8·48	3·83	31·12
Pig H. Balance period 2 (Linseed oil). ...	1175·4	1·42	11·18	12·60	3·59	7·71	·0012	·027	7·74	4·86	38·57
Pig H. Balance period 3 (Cod liver oil). ...	1175·4	1·42	11·18	12·60	3·66	7·70	·0072	·177	7·88	4·72	37·46

Figure 8.

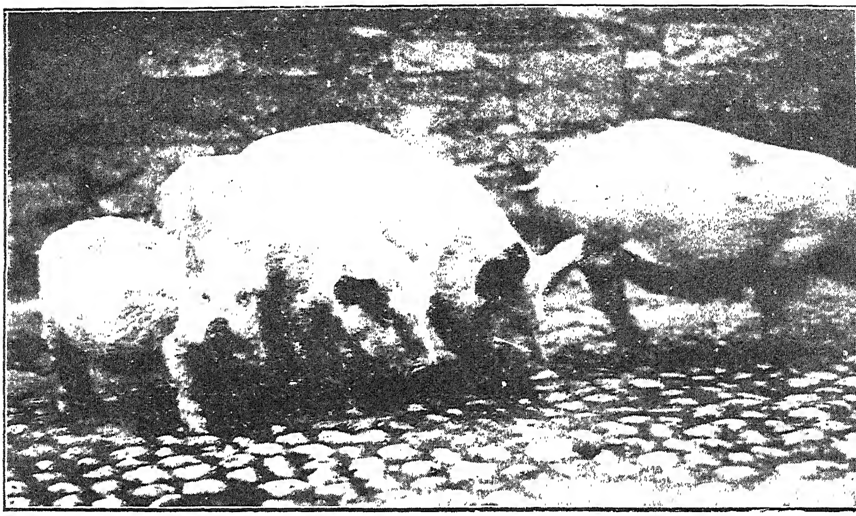


Figure 9.

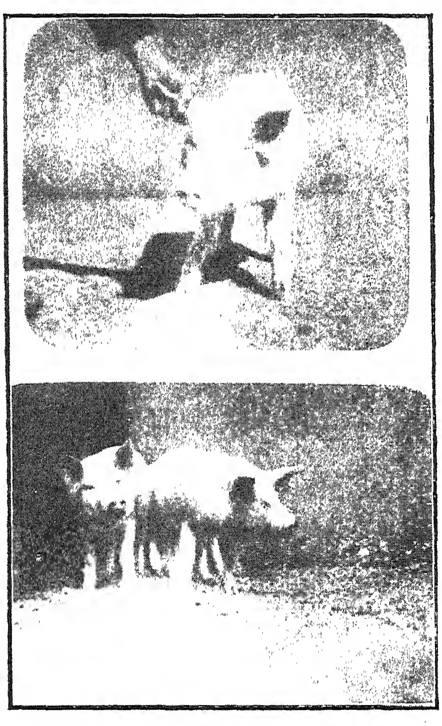
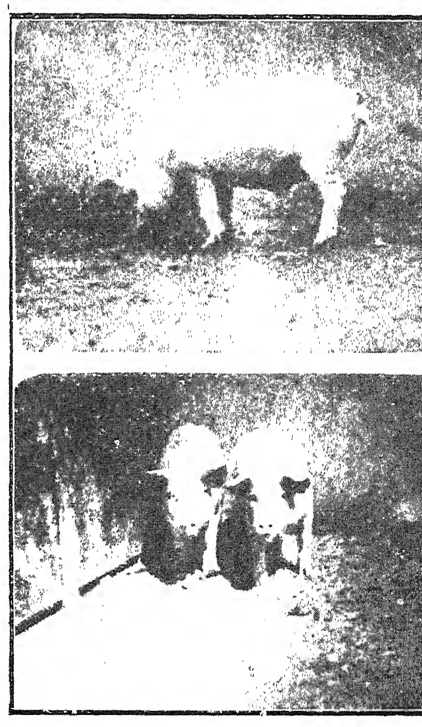


Figure 10.



		Phosphorus Balance.										
		Daily Intake of P_2O_5			Daily Excretion of P_2O_5						
					Faeces		Urine				
		Basic ration consumed daily (grams)	Food (grams)	Added Minerals (grams)	Total (grams)	% P_2O_5	Total P_2O_5 (grams)	% P_2O_5	Total P_2O_5 (grams)	Total in faeces and urine (grams)	Daily retention of P_2O_5 (grams)	Retention of P_2O_5 per 100 grams consumed
Pig G.	Balance period 1 (No oil). ...	941·4	10·05	4·00	14·05	4·78	8·02	·049	·66	8·68	5·37	38·23
	Balance period 2 (Linseed oil). ...	1175·4	12·56	4·00	16·56	4·28	8·00	·018	·41	8·41	8·15	49·21
	Balance period 3 (Cod liver oil). ...	1175·4	12·56	4·00	16·56	4·65	8·70	·009	·19	8·89	7·67	46·31
Pig H.	Balance period 1 (No oil). ...	941·4	10·05	4·00	14·05	4·56	8·58	·063	·92	9·50	4·55	32·39
	Balance period 2 (Linseed oil). ...	1175·4	12·56	4·00	16·56	4·18	8·97	·044	1·03	10·00	6·56	39·61
	Balance period 3 (Cod liver oil). ...	1175·4	12·56	4·00	16·56	4·40	9·26	·038	·94	10·20	6·36	38·41

EXPERIMENT 15.

For the second balance experiment of this series the pigs utilised were housed in the absence of direct light where they received a complete diet including supplemental minerals and linseed oil for 9 weeks previous to the experiment. The object of this was to exhaust the system of any vitamin D which might have been accumulated there so that the cod liver and linseed oils were compared on animals which presumably were approaching a condition of definite Vitamin D starvation. The retention of calcium and phosphorus was first determined on the diet containing linseed oil and subsequently on the same diet in which the linseed oil was replaced by a like quantity of cod liver oil. The animals were of course kept in the absence of direct light during the entire period of the experiment. The particulars of the experiment and the results obtained are as follows:—

Basic ration.

			CaO %	P_2O_5 %
Maize meal	...	5½ parts.	.027	.79
Barley meal	...	4 parts.	.080	1.41
Pollard	...	4 parts.	.123	1.57
Rice meal	...	3 parts.	.084	4.59
Linseed meal	...	2 parts.	.411	2.39
Blood meal	...	1½ parts.	.113	.58
Bran	...	1 part.	.103	3.06
Salt (NaCl)	...	½ per cent.	—	—
Steamed bone flour	...	1 per cent.	45.14	32.76
Precipitated chalk	...	1 per cent.	55.68	—

Sequence of experimental periods.

Introductory feeding period (5 days)—Basic ration, including minerals and linseed oil (1 oz. daily).

Preliminary feeding period (3 days)—in balance pen—Basic ration, including minerals and linseed oil (1 oz. daily).

Balance period 1 (8 days)—in balance pen—Basic ration, including minerals and linseed oil (1 oz. daily).

Interval (5 days)—Basic ration, including minerals and cod liver oil (1 oz. daily).

Preliminary feeding period (3 days)—in balance pen—Basic ration, including minerals and cod liver oil (1 oz. daily).

Balance period 2 (8 days)—in balance pen—Basic ration, including minerals and cod liver oil (1 oz. daily).

Calcium Balance

		Daily Intake of CaO			Daily Excretion of CaO						
					Faeces		Urine				
	Basic ration consumed daily (grams)	Food (grams)	Added Minerals (grams)	Total (grams)	% CaO	Total CaO (grams)	% CaO	Total CaO (grams)	Total in faeces and urine (grams)	Daily retention of CaO (grams)	Retention of CaO per 100 grams consumed
Pig I. Balance (Linseed Oil) period 1	1183	1·29	11·09	12·38	3·52	10·49	·0074	·138	10·63	1·75	14·14
Pig I. Balance period 2 ... (Cod liver oil).	1183	1·29	11·09	12·38	2·52	6·30	·0091	·178	6·48	5·90	47·66
Pig J. Balance period 1 ... (Linseed Oil).	1183	1·29	11·09	12·38	3·78	9·87	·0071	·147	10·02	2·36	19·06
Pig J. Balance period 2 ... (Cod liver oil).	1183	1·29	11·09	12·38	2·70	6·08	·0085	·206	6·29	6·09	49·19

Phosphorus Balance

		Basic ration consumed daily (grams)	Daily Intake of P_2O_5: Food (grams)	Daily Intake of P_2O_5: Added Minerals (grams)	Daily Intake of P_2O_5: Total (grams)	Daily Excretion of P_2O_5: Faeces: % P_2O_5	Daily Excretion of P_2O_5: Faeces: Total P_2O_5 (grams)	Daily Excretion of P_2O_5: Urine: % P_2O_5	Daily Excretion of P_2O_5: Urine: Total P_2O_5 (grams)	Daily Excretion of P_2O_5: Total in faeces and urine (grams)	Daily retention of P_2O_5 (grams)	Retention of P_2O_5 per 100 grams consumed
Pig I.	Balance period 1 (Linseed oil). ...	1183	21·69	3·60	25·29	6·06	18·06	·198	3·69	21·75	3·54	14·00
	Balance period 2 (Cod liver oil). ...	1183	21·69	3·60	25·29	5·18	12·95	·174	3·41	16·38	8·93	35·31
Pig J.	Balance period 1 (Linseed oil). ...	1183	21·69	3·60	25·29	6·28	16·39	·199	4·13	20·52	4·77	18·86
	Balance period 2 (Cod liver oil). ...	1183	21·69	3·60	25·29	5·46	12·29	·180	4·36	16·65	8·64	34·17

Results of Experiments 14 *and* 15.

In the case of experiment 14 the winter sunlight pigs receiving a complete diet were already retaining a considerable proportion, approximately one third, of the calcium and phosphorus ingested—balance period 1. The addition of linseed oil—balance periods 2—effected a slight yet definite increase in the retention of the two elements mentioned. When cod liver oil was substituted for linseed oil the absorption of calcium and phosphorus remained unchanged. In so far as the cod liver oil, which was known to be rich in vitamin D was not superior to linseed oil which contained none of the vitamin, the effect noted must be attributed to that of the oil *per se*. Presumably, however, if the pigs had been flooded with summer light the retention of calcium and phosphorus would, in the absence of oil, have reached a figure which, under the circumstances of this experiment, was reached only by the addition of oils—see the calcium and phosphorus retention in experiment 8. Another possible explanation of what appears to be the effect of oil *per se* lies in the greater consumption of food during both the oil feeding periods over the no-oil period. Evidence from other tests is to the effect that an increase in the organic food consumed caused an increased percentage retention of minerals.

Experiment 15 brought out very definitely, however, the superiority of cod liver oil (X) over linseed oil, and showed that in the case of pigs which had no reserve of vitamin D in their body previous to the experiment a phenomenal increase in the retention of both calcium and phosphorus, especially the former, occurred when cod liver oil (X) replaced a similar quantity of linseed oil.

Group Experiment: Only one group experiment was performed in this connection and it had for its object, the testing for vitamin D of an ordinary commercial sample of cod liver oil.

EXPERIMENT 16 (*Group Test*).

In this experiment the second brand of cod liver oil namely (Y) already described was compared with linseed oil to test their comparative utility for the purpose of protecting pigs against rickets. Two comparable groups were fed in the absence of direct light for a period of nine weeks. The basic diet consisted of:—

Maize meal	3½ parts.
Pollard	3½ parts.
Decorticated earth nut meal	1 part.
Steamed bone flour	1 per cent.
Precipitated chalk	1 per cent.
Common salt	½ per cent.

Group I received the basic diet plus 2 per cent. of linseed oil.
Group II received the basic diet plus 2 per cent. of cod liver oil (Y).

Each group contained 7 pigs. Both groups were fed on the basic diet alone in the absence of direct light for 2 weeks before the initial weight was recorded. The individual weight record of the pigs from both groups is shown in the following table.

	Initial weighing lb.	2nd weighing interval 3 weeks lb.	3rd weighing interval 2 weeks lb.	4th weighing interval 2 weeks lb.	5th weighing interval 2 weeks lb.	Gain. lb.
	44	60	71	82	100	56
	40	47	55	64	75	35
Group I.	41	50	56	61	73	32
	46	61	71	82	100	54
(Linseed oil).	40	45	52	57	65	25
	30	30	36	41	49	19
	32	36	40	44	50	18
Total ...	273	329	381	431	512	239
	41	52	62	65	75	34
	41	52	57	62	77	36
Group II.	54	68	69	77	90	36
	36	40	48	56	64	28
(Cod liver oil).	43	51	64	72	86	43
	31	35	42	47	56	25
	30	35	40	45	50	20
Total ...	276	233	382	424	498	222

At the end of nine weeks, that is on the occasion of the 4th weighing, both groups showed definite symptoms of rickets: some three or four pigs in each having developed abnormality of the limbs, but while the pigs had lost their suppleness there was no definite lameness. On the occasion of the last weighing the symptoms of rickets had markedly developed. The limbs had become bowed in some cases, bent inwards in others, swellings had appeared in the bones and a few pigs had developed definite lameness. There was no difference whatsoever in the rickety condition of both groups, and the illustrations—Figures 9 and 10—show the characteristic appearance of a number of animals from each group. From the table of weights and gains above it is clear that the progress made by both groups was similar.

Result of Experiment 16.

The comparative progress made by the two groups in this experiment warrants the conclusion that the particular brand of cod liver oil tested contained, if any, only a minimum of vitamin D. Its potency as a preventative of rickets was no greater than that of linseed oil, and from the practical point of view its value was on a level with that of linseed oil. Neither of the oils was effective to prevent the development of rickets in pigs fed as outlined and kept in the absence of light.

DISCUSSION.

In the experiments reported in this paper the rations were in all cases made up of ordinary farm foodstuffs which were so selected as to provide the pig with a diet complete in all respects except the item of nutrition under investigation in the particular test. No special provision was, however, made in respect of the vitamins with the exception of the D factor. Drummon, Zilva and Golding (83) showed that the vitamin A requirements of the pig were of a very low order; Orr and Crichton (67) have shown that there is no likelihood of a deficiency of either vitamin A or C in the case of pigs housed and fed under ordinary practical farming conditions, and Golding's results (84) also proved that no special provision need be made in the form of vitamin A to the pig's diet between weaning and slaughter. The multiple vitamin factor B was provided in abundance in the foods supplied during the experiments.

It is quite clear that when growing pigs are fed on cereals and cereal by-products together with a moderate allowance of milk, fish meal, or meat (and bone) meal, and when direct light is provided the diet is complete for the production of full normal growth and progress. When, however, the sources of protein mentioned (milk, fish and meat meal) are replaced by vegetable proteins, such as bean meal, earth nut or soya bean meal or blood meal, a deficiency of minerals immediately manifests itself. That the effects of such a deficiency may be obviated by the addition of inorganic mineral mixtures to the food has been demonstrated by numerous investigators. Proof of it has been forthcoming from balance experiments as well as from tests made under practical conditions of farming (15), (16), (35), (36), (37), (85). Further definite evidence is forthcoming from the experiments reported in this paper. The various reports do not agree, however, in their comparative description of the progress made by the mineral fed and the non-mineral fed groups of animals included in the experiments. In some cases the reports describe normality in one group and rickety condition in the other; while in other cases the difference is nothing more than a dissimilar rate of increase in body weight. In the latter case it is obvious that the non-development of a pronounced pathological condition in the non-mineral group must be explainable by the provision of straw litter in the pens, or by the choice of more or less grown pigs instead of immature ones, or by some such disturbing factor.

Where mineral supplements are necessary the results of the experiments reported herein show that from the weaning to the fat condition the only inorganic supplement necessary is a salt of calcium together with sodium chloride (common salt). Phosphates are present in abundance in the cereals and their by-products, and the results prove that a supplement of calcium carbonate is at least as effective as calcium phosphate; in fact there is a strong suggestion throughout the second series of experiments of a superiority of the carbonate over the phosphate. This is not surprising in view of the fact that the addition of calcium carbonate—precipitated chalk or ground limestone—corrects the improper balance between the calcium and phosphorus ratio in a diet made up of cereals or their by-products and vegetable proteins or blood meal. The addition of calcium phosphate—steamed bone flour—to such a diet does not, however, materially help in the rectification of the low calcium to phosphorus ratio. There is no definite experimental evidence to warrant the inclusion of any ingredient other than lime and common salt in an inorganic supplement. Under certain circumstances young bonhams living entirely on the mother's milk may develop anaemia, which is preventable by the administration, to them, of an iron salt. Another method of preventing the development of such trouble is to allow the little pigs access at an early age to food such as is subsequently given to them. A useful precaution in this respect is to place some coal ashes in a low box in a corner of the sty for the bonhams to help themselves to. A sample of coal ash secured from the ash-pit of the College contained 4.85 per cent. of iron oxide (Fe_2O_3). In the post-weaning stage the addition of iron, potassium, magnesium, iodine, sulphur, etc., is unnecessary and possibly to some extent injurious. A claim is sometimes made for complex mineral mixtures that they possess vermicidal properties. When, however, it is remembered that a fairly strong dose of santonin or other vermicide is necessary for the purpose of killing worms, and that the dose must be given on an empty stomach, it is clear that the small amount of vermicide contained in, say, 2 per cent. of the mineral mixture given to an animal replete with food could not have a useful effect in this direction.

With regard to the quantity of mineral supplement to be given the evidence is fairly definite also. Sodium chloride may be given in such quantity as is required to render the food palatable, and Rasenach's experiments (86) have shown that a pig of 30 to 40 lb. in weight may consume up to $\frac{1}{3}$ ounce of salt daily without injury. An addition of 2 per cent. of ground limestone (containing approximately 50 per cent. CaO) to the food mixture supplies all the calcium which is necessary. There was no evidence from the results of the experiments that 2 per cent. is excessive. Repeated experiments and continued observation have shown that sufficient lime is supplied to the pig in a diet of cereals and 10 per cent. of fish meal, or of meat meal of similar composition, or a supply of separated milk equivalent to about $\frac{1}{2}$ gallon per pig daily.

Equally important with the supply of minerals to growing pigs is the provision of the conditions necessary for their utilisation. In this respect direct light from the sun or light reflected from the sky is extremely

potent, and it behoves the pig keeper so to arrange his pig sty as to allow the light to pass freely (not through glass) into the compartments. Open yards are very serviceable in this connection. The incidence of rickets in pigs under practical conditions of farming is greatest in winter and spring when the supply of light is least. Tisdall and Brown (87) and Durno (88) have shown that the intensity of the ultra violet radiation from the sky is, in these latitudes, from six to eight times greater in mid-summer than it is in January. It is therefore clear that pig houses which are only sufficiently lighted to prevent rickets in the summer would cause pigs to go "off their feet" in winter, and there can therefore be no hard and fast rules as to the quantity of light necessary. Suffice it to say that sunlight is the cheapest form of nutrition, and that pig houses should be flooded with it to the maximum degree. The complementary relationship between mineral supply and direct light in the metabolism of minerals by pigs, and the variation in the efficacy of the light available at different times of the year, as well as a possible difference in the predisposition of different strains of pigs to rickets, explain the irregular occurrence of this trouble on the different conditions under which swine are ordinarily kept. The trouble is unknown on certain farms; in others it manifests itself in the form of unthrifty animals; while in still others the so-called rheumatic condition, accompanied perhaps by "staggers," obtains. The condition of "staggers" which commonly occurs on some farms in the country is akin to the condition of convulsions induced experimentally and described in connection with the fourth series of experiments reported in this paper. It is due to the exclusion of light from the pigs, or perhaps to this fact coupled with a deficiency of lime in the food. With reference to the supply of light it should be remembered that it is not necessary for the rays of the sun to shine directly on the body of the animal. Diffused sunlight or the light reflected from the sky is quite effective though not as potent a supply of the vitamin D factor as direct sunlight. Obviously an open window or half door looking southwards catches more light than one facing northwards.

When the housing accommodation does not allow of the entrance of direct light, and especially when the light available is dull and of low anti-rachitic value, as it is for instance in the dark months of winter, alternative sources of this very necessary factor must be sought. The results herein reported definitely show that cod liver oil is quite effective in aiding mineral utilisation in the pig, and that in this respect it is very definitely superior to non-vitamin oils such as linseed oil. On the other hand the results also show that, unfortunately, some of the commercial samples of cod liver oil sold for animal feeding are quite impotent in vitamin D, and that consequently they are of no more use than linseed or other oils. Unfortunately also there is no short chemical or physical method of assaying an oil for vitamin D—a complete biological test on living animals must be performed, and in the absence of such test reliance must be placed on the reputation of the brand or of the firm supplying it. A word of warning is therefore issued against the purchase of a nondescript cod liver oil without some guarantee of its vitamin D potency. All liver oils are rich in this valuable factor, but

animal oils other than liver oil contain only a trace of it, and the potency of a particular sample of cod liver oil depends on the method of extraction, the condition of storage, and more particularly on the presence or absence of an admixture of other impotent oils. In this connection it is interesting to note that Holmes (89) found that oil from the rotting process was lower in vitamin content than that obtained directly from fresh livers, and that Drummond, Golding and Zilva (62) came to the conclusion that brown cod liver oils compared favourably with medicinal oils. The quantity of an average potent sample of cod liver oil which protects a pig from rickets is about 1 per cent. of the total feed, that is, an animal of 10 weeks of age eating $2\frac{1}{2}$ lb. of food daily would require about 1 tablespoon or $\frac{1}{2}$ ounce of oil per day, provided of course the vitamin D factor is supplied from no other source. Possibly less of a very potent oil would suffice.

It must not be supposed that because cod liver oil and added minerals are of utility to the pig under certain circumstances the addition of these is economic or even advisable under all circumstances. Crowther (73) found that the addition of cod liver oil to a ration of cereals had no appreciable effect on the rate of growth, and Paterson and Cochrane (90) showed definitely that the addition of $\frac{1}{2}$ ounce of cod liver oil daily to a basic diet of maize, pollard, barley, supplemented by fish meal or earth nut meal and minerals, did not enhance the value of the ration. Presumably in both these cases the pigs received direct light in abundance. Similarly there is no justification for using additional minerals when the diet already contains a sufficiency of these. Paterson's experiments (91) show clearly that the addition of either ground limestone or steamed bone flour to a pig's ration which already contained 10 per cent. of fish meal had no beneficial results, and similarly the experiments of Rice and Mitchell (92) made it clear that the feeding of added minerals to growing pigs on rations containing either tankage (slaughter-house offal containing bone) or pasture had no appreciable effect on the rate or economy of the gains secured. In fact there is a possibility of excessive minerals doing injury. Robertson and Basket (93) draw attention to the fact that a lot of pigs on free range receiving maize meal, pollard, extracted soya bean meal and $\frac{1}{2}$ gallon of separated milk each daily, made better gains than a similar lot which were similarly treated but got minerals in addition, and Evvard et al. (18) also draw attention to a depression in the rate of progress in a group of pigs possibly due to excess of minerals.

Deficiency of minerals, particularly of calcium, has hitherto been discussed from the aspect of effect on growth or the production of pathological conditions. It is the experience of butchers that mineral fed pigs possess much stronger and harder bone than those fed on a mineral deficient diet, and it is no uncommon experience for the bones of fat pigs to snap under the stress put on them during transit to the factory or at fair greens. It is interesting to note that similar trouble of brittleness of bone in sheep due to mineral deficiency in their pastures is reported by McKenna from South Australia (94). More definite knowledge in this connection is forthcoming from some experiments performed at Nebraska (95), where it was

found that the addition of ground bone to a diet of maize and pollard increased the breaking strength of the bone of the pig produced therefrom by over 100 per cent. While a level of mineral retention which would affect the quality of the bone without producing any other obvious consequences may not be a matter of great concern in the fattening pig, it is on the other hand of very serious import in the young growing pig, and especially in the animal intended for stock purposes as well as in the breeding sow. Consequently a correct supply of minerals, and suitable conditions for their assimilation, are of especially great importance in the case of these animals.

Nature helps the pig, as it does other animals, in its choice of food. When, for instance, pigs resort to " rooting " in a pasture they do so in search of mineral ingredients which are wanting in the diet. The results of an Ohio Station Experiment (96) showed that when the basic ration was limited to cereals, pigs which were allowed to " root " in bare soil made more rapid growth and grew healthier and stronger bone than similar pigs which did not get the opportunity to root. In other words, the soil consumed acted as a safety factor. The desire to root is not a vicious habit, because when pigs are supplied with abundance of minerals in their diet they no longer " root " (92), (93).

It must not be concluded that soil or some similar source of minerals of mysterious potency is at all necessary. It is definitely known that cereals together with a definite supply of protein and a supplement of common salt and lime can, in the presence of direct light, supply a pig with all the requirements for growth and production. Most soils are only a poor source of lime, while certain soils are deficient in it. Similarly coal ash, which is often supposed to have special merits in the way of mineral content, contains only about 4 per cent. of calcium oxide, so that neither coal ash nor soil can compare as sources of lime with ground limestone, an ordinary sample of which contains about 50 per cent. of calcium oxide. Coal ash and soil are, of course, sometimes made available to young pigs as a curative for scour. Green food also supplies lime in moderate amount, which, when lime is deficient in the diet, is most efficacious, just as the vitamin contained therein is particularly useful when sunlight or other source of the vitamin D factor is lacking. The results of experiments recorded show clearly however that when the diet is otherwise complete in its protein, minerals and vitamin D content, green food does not contribute any additional food factor.

CONCLUSIONS.

(The conclusions represented in italics are deducible from the evidence supplied by the results of the experiments reported in this paper).

1. *Cereals and their by-products, which form the major portion of the food of the pig, and vegetable cakes are seriously deficient in lime*: roots and tubers are deficient both in lime and phosphates: all the foods mentioned have a low content of common salt (sodium chloride).

2. *Inorganic mineral supplements are assimilable by the pig; and evidence is available from the balance experiments of increased retention of calcium and phosphorus when these elements are added under appropriate conditions to a diet deficient in them.*

3. When a pig ration includes separated milk to the extent of about ½ gallon per pig daily or 10 per cent. of fish meal, or of a meat meal of approximately similar composition, there is no necessity whatsoever for adding anything in the way of mineral supplement to the ration.

4. *When the major portion of the diet of a pig consists of cereals and their by-products, and when separated milk, fish meal, and meat (and bone) meal are absent, the mineral constituents which are likely to be deficient are lime (calcium) and common salt. The feeding of supplementary iodine produces no beneficial effects. Neither is there any advantage in the feeding of iron* except perhaps in special circumstances where anæmia prevails in bonhams of from 3 to 5 weeks old. Such trouble can usually be prevented by giving early access to food or by affording the pigs an opportunity to "root" at coal ash or soil. *Similarly there is no justification whatsoever for including sulphur in a mineral mixture. The addition of potassium,* magnesium etc. *is also unproductive of useful results.*

5. *Phosphates abound in cereals and their by-products* but they are deficient in roots and tubers. Where the latter form the greater part of the pig's ration phosphates should be given in addition to the other minerals mentioned *but where the cereals predominate in the ration as is usually the case the addition of phosphates is unnecessary.*

6. *Calcium may be usefully supplied either in the form of a phosphate (steamed bone flour or bone black) or in the form of a carbonate (precipitated chalk or ground limestone) and when used as a supplement to a ration in which cereals predominate the carbonate form gives equally good if not better results than the phosphate form.*

7. *The necessary calcium in a supplemental mineral is supplied by* 2 *per cent. of fairly pure ground limestone or a mixture of ground limestone and steamed bone flour.* Common salt may be fed at the rate of from ⅛ to ¼ ounce per pig daily.

8. *Where a mineral supplement is necessary (see paragraph 3) it may be fully supplied by one of the following mixtures given in the quantity prescribed.*

No. 1.	*Ground Limestone*	2 *parts*	2½% *added to the food.*
	Common Salt	½ *part*	
No. 2.	*Ground Limestone*	1 *part*	2½% *added to the food.*
	Steamed Bone Flour	1 *part*	
	Common Salt	½ *part*	

When potatoes, or a mixture of potatoes and roots are fed in considerable quantity the mineral mixture No. 2 is to be preferred to No. 1.

9. *The assimilation of minerals by the pig requires the presence of a plentiful supply of a factor known as vitamin D or the anti-rachitic vitamin.*

10. *Direct sunlight is a very potent source of this factor and a plentiful supply of it is essential to successful pig raising. All pig houses should be so constructed that they may be flooded with sunlight.*

11. Liver oil is another potent source of the anti-rachitic factor: *cod liver oil is definitely superior to linseed or other non-vitamin oil, and the beneficial effect of cod liver oil in enabling a pig suffering from a vitamin D deficiency to increase its retention of calcium and phosphorus is not due to the oil per se, but rather to the vitamin factor contained in it.*

12. *Commercial samples of cod liver oil may, however, for a number of reasons contain little or none of the vitamin factor, and the indiscriminate use of cod liver oil without a guarantee of its vitamin potency may yield negative results.*

13. Another fairly rich source of the same factor is green food, which, of course, also supplies calcium rich minerals as well as useful protein material.

14. *The absence of sunlight or potent cod liver oil or green feeding brings about, even in the presence of abundant minerals, a train of events culminating in rickets, "cramp," "staggers" and convulsions.*

15. *Deficiency of minerals results in soft bone, unthriftiness, poor development, depraved appetite and ultimately rickets.*

16. Pigs on free range in pastures never develop any of the troubles mentioned in paragraphs 14 and 15 because of the supply of minerals from the soil and green food, and in virtue also of the presence of the factors necessary for mineral assimilation in the available light and in the green food. The evidence shows, however, that all food factors in soil and green feeding can be otherwise supplied to pigs confined indoors.

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FIELD EXPERIMENTS, 1929.

The following report deals with Field Experiments conducted in 1929. These experiments comprised trials with varieties of crops, experiments with nitro-chalk and other nitrogenous manures on root crops, and manurial trials on grass-lands.

The detailed returns in respect of each test conducted by Agricultural Instructors may be found in the Annual Reports issued by the County Committees of Agriculture, and farmers and others interested are recommended to apply for a copy of the report to the Agricultural Instructor or to the Secretary of the County Committee for the County.

I.—EXPERIMENTS WITH VARIETIES OF CROPS.

Wheat.

Trials with Autumn or Winter sown varieties of wheat were conducted by Agricultural Instructors in each county in the Saorstát during the season 1928-29. The varieties included in the tests were as follows:—Queen Wilhemina, Yeoman II, Red Stettin, Coney Island (short straw) and Coney Island (long straw). The first two varieties mentioned are well known and have been included in these trials for a number of years past. The other varieties, which were derived from selections from old native wheats, were included for the first time in these trials in 1928 and are fully described in the report on that season's trials.

At four centres at which trials were conducted the seed germinated weakly and the resulting crops were so patchy and weedy that it was not considered necessary to determine the yields. At two other centres the crops lodged badly and reliable returns could not be secured. Detailed returns were, however, obtained from 38 centres and these are set out in Table I.

At most centres all varieties ripened at about the same time. In five cases it was reported that Queen Wilhelmina and Yeoman II were ripe from three to five days earlier than the other varieties. At three other centres Red Stettin ripened first and, in two cases, Coney Island (long straw) and Coney Island (short straw) varieties were said to be ready for harvesting a few days before the other varieties were ripe.

The Coney Island (long straw) variety lodged badly at almost all centres. Red Stettin lodged at six centres and Coney Island (short straw) at one centre. Practically no lodging occurred at any centre on the plots sown with Yeoman II or Queen Wilhelmina.

Queen Wilhelmina produced, on the average, a distinctly heavier yield of grain than any of the other varieties. Somewhat similar returns were obtained from Yoeman II, Coney Island (short straw) and Red Stettin. Coney Island (long straw) again proved to be definitely inferior in yielding capacity to the other varieties included in the trials, and as this variety is strongly susceptible to lodging it cannot be recommended for general cultivation.

The quality of the grain produced in all cases was considered satisfactory

though in a few cases it was reported that the grain of Yeoman II and Red Stettin was comparatively small.

TABLE I.

County.	Character of Soil.	Date of Sowing.	Queen Wilhelmina. Yield per Statute Acre Grain C. Q.	Straw C. Q.	Red Settin 13. Yield per Statute Acre Grain C. Q.	Straw C. Q.	Coney Island (Long Straw) Yield per Statute Acre Grain C. Q.	Straw C. Q.	Coney Island (Short Straw) Yield per Statute Acre Grain C. Q.	Straw C. Q.	Yeoman II. Yield per Statute Acre Grain C. Q.	Straw C. Q.
Carlow ...	Medium loam	26.2.29	30 3	50 2	22 3	39 0	17 3	42 0	21 1	40 2	23 3	42 1
Clare ...	Friable loam ...	17.1.29	30 0	38 2	21 2	36 1	21 2	36 0	25 3	34 1	25 3	34 1
,, ...	Light loam ...	–.11.28	28 2	35 2	24 1	38 0	25 1	37 2	28 3	36 2	26 1	32 0
Cork ...	Rich clay loam	9 and 13.11.28	30 3	44 1	17 2	53 0	13 0	51 0	21 3	40 1	26 1	50 3
,, ...	Heavy loam ...	9.11.28	24 1	47 3	26 3	50 1	15 1	59 1	18 0	43 0	25 3	44 3
,, ...	Medium loam	10.2.29	11 1	24 1	18 3	29 1	15 0	24 0	17 2	22 1	12 1	18 1
,, ...	Medium loam	9.11.28	18 1	30 0	16 2	35 1	14 3	35 3	17 1	36 3	13 2	33 3
,, ...	Heavy loam ...	16.1.29	28 1	43 1	19 3	49 2	17 3	46 0	25 0	41 2	24 3	45 0
,, ...	Medium sand-stone loam.	14.1.29	20 2	28 3	15 3	24 1	16 1	33 0	22 2	22 1	26 3	27 3
,, ...	Med. gravelly sandstone loam	14.1.29	22 1	46 1	15 3	36 0	20 2	38 2	25 1	35 2	15 3	30 2
,, ...	Sandy loam ...	9.1.29	22 3	49 1	20 0	45 2	14 3	41 2	18 0	39 2	20 3	36 0
Donegal ...	Heavy clay with mixture of peat	26.1.29	20 2	—	17 3	—	22 2	—	21 1	—	19 4	—
Dublin ...	Light loam ...	8.11.28	31 2	44 3	26 0	45 1	23 0	48 3	27 3	35 3	29 0	37 1
Galway ...	Med. limestone loam.	12.12.29	20 0	40 0	17 3	36 0	16 0	31 0	16 0	30 1	15 2	30 0
,, ...	Clay loam ...	12.1.29	20 3	30 0	19 2	34 0	18 0	33 0	17 1	28 0	16 3	25 0
Kerry ...	Medium loam	6.11.28	23 3	—	22 1	—	20 0	—	22 1	—	23 0	—
Kildare ...	Medium loam	2.11.28	28 2	53 2	28 3	52 1	22 0	54 1	25 3	53 3	27 2	57 0
,, ...	Clay loam ...	5.12.28	29 3	56 1	25 3	53 2	23 1	57 1	27 0	54 3	26 1	53 0
Kilkenny ...	Medium loam	30.11.28	25 3	38 0	24 2	40 1	24 3	44 3	22 0	35 2	27 2	38 2
Laoighis ...	Peaty loam ...	8.11.28	22 1	38 0	20 1	36 0	20 2	45 0	21 1	32 0	19 2	36 0
,, ...	Medium loam	27.11.28	19 1	38 0	17 3	43 1	16 2	51 2	19 3	36 0	18 1	39 0
Leitrim ...	Clay loam ...	23.11.28	22 2	37 0	20 0	35 2	19 2	36 3	19 0	34 0	23 3	31 0
Limerick ...	Clay loam ...	5.12.28	35 0	48 0	24 0	48 0	27 2	46 0	29 0	39 0	35 0	45 0
Longford ...	Limestone ...	9.11.28	34 1	43 3	28 0	46 1	30 0	47 0	31 2	44 3	31 3	42 2
Mayo ...	Clay loam ...	8.1.29	22 2	40 0	19 3	37 0	—	—	21 0	36 3	21 3	40 0
Monaghan ...	Sandy loam ...	7.2.29	21 3	34 1	16 2	36 0	13 1	37 3	20 0	34 3	21 1	35 2
Offaly ...	Medium loam	7.11.28	27 2	—	21 1	—	21 0	—	24 3	—	24 0	—
Roscommon ...	Heavy clay ...	5.12.28	32 3	37 2	21 1	45 0	18 3	37 2	25 0	34 1	31 1	37 2
,, ...	Medium loam	—	20 1	36 0	15 2	29 3	—	—	21 0	36 2	19 2	32 0
Sligo ...	Rich loam ...	19.2.29	31 0	37 2	29 0	39 0	23 0	41 2	27 0	34 0	28 3	35 0
Tipperary, N.R.	Sharp clay loam	31.12.28	24 1	63 0	28 1	61 0	21 2	65 0	17 3	61 0	19 1	57 0
,, ,, ...	Strong clay ...	22.12.28	30 0	74 0	28 3	76 0	25 1	81 0	26 2	71 0	32 1	66 0
Tipperary, S.R.	Med. clay loam	21.1.29	24 3	42 2	24 2	44 0	20 0	48 2	22 2	40 2	25 2	38 2
Waterford ...	Medium loam	7.12.28	20 1	40 1	16 0	49 0	15 1	42 0	16 3	41 0	13 3	42 2
Westmeath ...	Medium loam	6.11.28	23 1	47 1	17 0	42 3	17 0	39 2	15 3	38 1	19 2	46 0
Wexford ...	Shingly clay ...	8.11.28	40 0	60 0	22 2	48 0	28 0	44 2	22 1	43 0	26 5	46 0
Wicklow ...	Medium loam	9.11.28	24 1	39 2	21 2	30 0	17 3	33 0	22 1	36 2	19 3	36 0
,, ...	Deep loam ...	4.12.28	22 2	35 0	21 0	37 2	15 3	36 0	17 0	34 2	19 1	35 2
Average yield per statute acre, (Grain 38 centres, Straw 35 centres)		—	25 2	42 2	21 2	42 2	19 1	41 1	22 2	38 3	22 3	39 1

Oats.

In the season of 1929 trials with oats were confined to white varieties. Two series of experiments were conducted (a) a series in which Victory II, Glasnevin Sonas, formerly described as Banner-Tartary, Victory Mogul and Mansholts III were compared, and (b) a series of trials with three strains of potato oats. As in the similar trials conducted in previous years, the seed of each variety tested was derived from pure line selections.

Trials with Victory II; Glasnevin Sonas; Victory Mogul and Mansholt's III.

All four varieties were included in the similar trials conducted in 1928, in the report on which the varieties were fully described. During the past season tests were conducted at 23 centres in 17 counties. Detailed returns from the different centres and the average yields from all centres are shown in Table II. At a number of centres lodging occurred, but at no centre was the Glasnevin Sonas variety affected. This variety was, however, the latest to ripen in nearly all cases and on the lighter and poorer types of soil it produced a rather small grain. Glasnevin Sonas produced, on the average, a slightly heavier yield of grain than Victory II or Victory Mogul. Mansholts III, as in the previous season's trials, again proved inferior in yielding capacity to the other varieties tested.

TABLE II.

County.	Character of Soil.	Yields per Statute Acre							
		Victory II.		Glasnevin Sonas.		Mansholt's III.		Victory-Mogul.	
		Grain. C. Q.	Straw. C. Q.	Grain. C. Q.	Straw. C. Q.	Grain. C. Q.	Straw. C. Q.	Grain. C. Q.	Straw C. Q.
Carlow	—	17 3	33 0	19 3	29 2	16 2	27 0	20 3	34 2
Clare	Light loam ...	21 1	34 1	24 2	31 1	20 3	30 0	23 0	33 0
,, ...	Peaty loam ...	32 2	39 1	20 2	35 2	31 0	38 2	32 3	40 3
Cork	Clay loam ...	30 1	49 1	33 3	51 2	31 0	48 1	25 1	50 3
,, ...	Deep loam ...	26 3	54 1	30 2	51 0	28 0	46 3	30 2	49 3
,, ...	Heavy loam ...	30 0	57 0	26 2	34 3	27 0	39 1	27 3	41 2
,, ...	—	—	—	—	—	—	—	—	—
,, ...	Light loam ...	20 0	29 1	20 0	40 1	19 3	27 0	17 0	23 0
Dublin	Heavy clay loam ...	29 3	42 3	31 2	50 1	30 3	49 3	22 2	35 3
Kerry	Rich loam limestone	25 2	41 0	27 0	40 0	24 0	38 0	25 2	40 0
,, ...	Strong loam ...	32 1	57 3	33 0	52 3	31 3	50 3	32 1	50 0
Kildare ...	Clay loam ...	22 3	38 3	20 3	35 1	21 1	42 2	24 0	39 1
Kilkenny ...	Medium loam ...	35 3	38 0	40 1	39 2	32 2	34 1	34 0	42 1
Laoighis ...	Loam	28 1	41 2	30 2	39 3	28 0	40 0	29 3	40 3
Limerick ...	Loam	26 0	55 0	30 0	60 0	24 2	46 0	30 0	58 0
,, ...	Medium limestone loam.	27 2	41 2	26 0	44 0	24 0	38 0	29 1	37 2
Louth	Light Clay ...	30 0	35 0	21 3	27 0	24 2	28 1	29 2	31 0
Offaly	Clay loam ...	17 1	31 2	16 1	28 2	19 2	29 2	17 3	30 3
Tipperary, N.R. ...	Deep loam ...	37 1	52 0	25 3	45 0	34 2	52 0	31 2	49 0
Tipperary, S.R. ...	Heavy clay ...	27 0	51 0	35 0	65 0	27 0	43 0	30 2	52 2
Waterford ...	Medium loam ...	26 1	58 3	30 2	65 1	28 1	57 3	25 4	52 2
Westmeath ...	Medium loam ...	23 3	38 3	22 1	33 2	19 1	27 3	21 3	32 3
Wexford ...	Shingly loam ...	32 0	36 3	35 0	42 0	30 0	38 2	35 0	44 0
Wicklow ...	Medium loam ...	25 3	35 0	33 2	39 0	28 3	34 0	31 2	38 0
Average yield per statute acre, (23 centres)		27 1	43 0	28 0	42 2	26 1	39 1	27 1	41 1

Trials with Different Strains of Potato Oats.

Trials were again conducted with the three strains of potato oats included in the similar tests carried out in 1928. In the past season the experiments were conducted at nine centres in the districts where potato oats is still widely cultivated. The detailed returns from the different centres and the average yields from all centres are shown in Table III.

Potato (1) produced, on the average, the highest yield of grain and it also gave the best return at 7 of the nine centres at which trials were conducted. Potato (3), which gave the heaviest yield of grain in the previous season's trials, again ripened much later than the other two strains at almost all centres.

TABLE III.

County.	Character of Soil.	Yields per Statute Acre.					
		Potato (1).		Potato (2).		Potato (3).	
		Grain. C. Q.	Straw. C. Q.	Grain. C. Q.	Straw. C. Q.	Grain. C. Q.	Straw. C. Q.
Cavan	Rich loam ...	18 0	30 0	16 1	28 0	13 4	26 0
Leitrim	Clay loam ...	23 2	36 2	22 0	34 3	21 2	34 0
Longford	Medium limestone	35 2	44 1	30 0	40 1	31 2	47 0
Mayo, S.	Light loam ...	22 3	40 0	20 2	41 0	18 3	38 3
Mayo, N.	Medium loam ...	22 0	38 2	20 1	38 2	19 0	37 1
Monaghan	Loam	16 2	25 1	17 2	29 2	15 3	26 2
Roscommon, N. ...	Heavy clay ...	24 2	36 0	21 3	33 2	23 0	33 0
Roscommon, S. ...	Light sandy ...	19 1	30 2	17 3	26 3	20 2	29 2
Sligo	Medium loam ...	32 0	36 0	27 0	32 0	23 2	35 0
Average yield per statute acre (9 centres)		23 3	35 1	21 2	33 3	20 3	34 0

Supplies of Pure Line Seed.

In connection with the Department's scheme for the distribution of pedigree seed oats amongst farmers "extension" plots of the principal varieties have been grown at various centres for a number of years under the supervision of the Department and the Agricultural Instructors, and considerable quantities of seed, particularly of Victory II, Glasnevin Sonas and Black Tartary are now available in some counties. Growers are recommended to ascertain from the Agricultural Instructor for their district where supplies of seed of these and other varieties may be obtained.

Potatoes.

The Old Champion, once the most widely grown variety in this country, has, in recent years, proved so susceptible to disease and so poor a yielder that the acreage has considerably declined.

As a result of investigations conducted recently it is now known that certain virus diseases, chiefly Leaf Roll and Mosaic, are mainly responsible

for the inferior yields which have been obtained from the Old Champion. Since the variety was once a good cropper and as it still possesses remarkable vigour and produces tubers unsurpassed in quality the Department have, for some years past, been engaged in an endeavour to produce a healthy stock of Old Champion and so possibly revive its cropping qualities. An account of this work has already been published in the Department's JOURNAL.* By judicious selection and isclation a limited supply of apparently healthy seed of Old Champion had been secured at the end of the growing season of 1928. It was then decided that this improved or rejuvenated Old Champion should be included in the trials to be conducted by the Agricultural Instructors in 1929. In addition, four other varieties were included, Up-to-Date, Kerr's Pink and Arran Consul, which were also tested in the two previous years, and Arran Banner, which was introduced for the first time into these trials in 1929.

Arran Banner is a new, immune, early maincrop variety with an upright halm and abundant straggling foliage. Flowers are rarely produced and the tubers are white-skinned, white-fleshed, and round.

The "seed" of all varieties was procured from one centre in County Donegal and trials were conducted at one or more centres in each County. Detailed returns from the 40 centres at which the experiments were conducted are set out in Table IV.

TABLE IV.

VARIETY.	Average yield per Statute Acre, 1929. 40 centres.								Average total yield per St. Acre, 1928. (43 centres).	
	Saleable.		Small.		Diseased.		Total.			
	T.	C.	T.	C.	T.	C.	T.	C.	T.	C.
Arran Banner ...	16	7	1	1	0	3	17	11	—	
Up-to-date	15	13	1	10	0	3	17	6	12	15
Kerr's Pink ...	13	13	1	14	0	2	15	9	12	19
Arran Consul ...	13	5	0	18	0	3	14	6	11	16
Old Champion (Rejuvenated). ...	10	13	2	3	0	7	13	3	—	

Towards the end of the growing season it was reported that a small proportion of the plants on the Old Champion plots were affected with Mosaic disease. At some centres no disease was noticed and even at the centres where it was present only a small number of plants were attacked. Nevertheless, it was quite evident that Mosaic disease was present to

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some extent in the "seed" used in these trials and which was believed to be healthy. In view of the fact that Mosaic disease is to be found on practically every plant of Old Champion grown on the ordinary farm, and that the disease is also prevalent on most varieties in general cultivation, it is not at all surprising that a small proportion of the apparently healthy plants from which the stock of seed was derived was slightly affected by the disease. Since a proportion of the plants were diseased the yields produced by Old Champion in these trials, although fairly satisfactory, particularly as regards the quantity of diseased tubers, cannot be taken as fairly indicative of the value of disease-free seed. Work on the production of such seed is still in progress and it is expected that in the course of a season or two it will be possible to provide for inclusion in these trials a stock of healthy Old Champion seed.

Arran Banner produced a heavier yield than any of the other varieties. As, however, this was the first season in which the variety was included in these trials it is not advisable, pending further tests, to arrive at a definite conclusion as to its value.

Arran Consul compared less favourably in yielding capacity with the standard varieties, Up-to-Date and Kerr's Pink, than in previous trials. It was again reported that this variety missed badly at a number of centres and that it appeared to be very susceptible to "black-leg" disease.

Root Variety Trials.

Tests with varieties of both mangels and turnips were conducted by Agricultural Instructors in each county during the season of 1929. In the mangel variety trials the varieties which had given satisfactory returns in previous tests, namely, Yellow Globe, Red intermediate, and Lord Warden, were again included at all centres. Similarly, in the case of the trials with swedes two varieties, Magnificent and Tipperary, which have consistently given good yields in these tests were sown at all centres. In addition, as in previous seasons, a number of varieties of both mangels and swedes supplied by Irish seedsmen were included at practically all centres. The detailed returns obtained in each trial have already been published in the annual reports issued by the various County Committees of Agriculture.

Grass Seed Mixtures.

During the season of 1926 a series of experiments were laid down by Agricultural Instructors at 37 centres with the object of comparing the relative value for the production of hay and pasture of the mixture of grasses, including Italian Rye Grass and Meadow Fescue and clovers, which has been widely employed for a number of years with satisfactory results, and a mixture from which Italian Rye Grass and Meadow Fescue were excluded,

and an additional quantity of Cocksfoot included instead. The following mixtures of grasses and clovers were sown at each centre:—

I.			II.		
15	lb.	Perennial Rye Grass	15	lb.	Perennial Rye Grass
7	,,	Italian Rye Grass	3	,,	Timothy
4	,,	Meadow Fescue	9	,,	Cocksfoot
3	,,	Timothy	2	,,	Broad Red Clover
3	,,	Cocksfoot	2	,,	Late Flowering Red Clover
2	,,	Broad Red Clover	1	,,	Alsike Clover
2	,,	Late Flowering Red Clover	1	,,	White Clover
1	,,	Alsike Clover			
1	,,	White Clover			

In the season of 1927, when the plots at all centres were mown for hay, slightly better returns were obtained where the mixture containing Italian Rye Grass and Meadow Fescue was sown. During the season of 1928 reports were received from 29 of the 37 centres at which the experiment was originally laid down. At the 15 centres where the plots were again mown for hay practically similar yields were produced by both mixtures. From eight of the fourteen centres where the plots were in pasture it was reported that there was a better sole of grass and a greater abundance of clovers on the plot sown with the mixture from which Italian Rye Grass and Meadow Fescue were omitted than on the corresponding plot sown with the mixture in which both of these grasses were included. At the remaining seven centres there was no noticeable difference in the appearance of the pasture on the different plots.

During the season of 1929 reports were received from 24 of the 37 centres at which the plots were originally laid down in 1926. At 21 centres the plots were grazed and it was reported that at 14 of these the pasture produced from the mixture of seeds containing the relatively large proportion of cocksfoot was earlier, contained a great proportion of clovers and had a thicker sole of grass than that produced from the mixture in which the proportion of cocksfoot was relatively small. At five centres there was no noticeable difference between the pastures from the two sets of plots, but the remaining two sets of plots showed in favour of the mixture in which but a small proportion of cocksfoot was included. At the 3 centres where the plots were meadowed the results were in favour of the mixture containing the higher proportion of cocksfoot.

From the further series of similar trials laid down at ten centres in 1927 it has already been reported that, during the first season when the plots were meadowed, the mixture containing the relatively large proportion of cocksfoot gave the heavier average yield by 3½ cwt. per statute acre.

During the season of 1929 reports were received from 8 of these 10 centres. At three centres the plots were grazed and at the remaining five centres they were meadowed. The weight of hay from the plots laid

down with the mixture where Italian Rye Grass and Meadow Fescue were substituted for portion of the cocksfoot was on the average 2 cwts per statute acre less than that produced from the plots sown with the mixture of grass seeds containing the higher proportion of cocksfoot. From two of the three centres where the plots were grazed it was reported that there was an earlier growth, a better development of clovers and a thicker sole of grass on the plots sown with the mixture containing the large quantity of Cocksfoot.

Although it is not advisable pending further trials to draw definite conclusions, it is evident that equally good, if not better, returns can be secured on many soils from a mixture in which a large proportion of Cocksfoot is substituted for Italian Rye Grass and Meadow Fescue than from the more widely used mixture in which both of these grasses are included.

II.—EXPERIMENTS WITH NITRO-CHALK AND OTHER NITROGENOUS MANURES.

As nitro-chalk, a new form of nitrogenous manure, has recently been placed on the market it was considered advisable that experiments to compare it with the commonly used forms of nitrogenous manures, viz.:—Nitrate of Soda and Sulphate of Ammonia, should be conducted. It was, accordingly, arranged that a series of manurial experiments on both mangels and swedes should be laid down in each County by the Agricultural Instructors during the season 1929. Since the usual practice in the manuring of root crops is to apply Sulphate of Ammonia at the time of sowing and nitrate of soda as a top dressing after the crop is singled, it was arranged that nitro-chalk should be applied both at the time of sowing and as a top dressing.

In the trials on mangels all plots at each centre received similar dressings of farmyard manure, superphosphate and kainit. One plot, which served as a control, received no nitrogenous manure. Dressings of one or other of the three nitrogenous manures were applied to the other four plots, equal quantities of nitrogen being applied in each case. In the experiments on swedes a similar arrangement was adopted except that no farmyard manure was applied to any of the plots. Trials on mangels were conducted at 34 centres and on swedes at 28 centres. Detailed particulars of the manures applied to each plot and the yields obtained in the experiments on mangels and swedes are set out in Tables V. and VI. respectively.

In both series of trials nitro-chalk and sulphate of ammonia produced practically similar results. In the experiment on swedes nitro-chalk and nitrate of soda, both applied in the form of a top dressing after the crops were singled, produced almost equal returns. In the corresponding trials on mangels slightly better results were obtained from the nitrate of soda.

TABLE V.

County.	Character of Soil.	Manures Applied and Yields obtained per Statue Acre. Plot. I. 20 tons Farm-yard manure 4 cwt. Super, 4 cwt. Kainit, 298 lb. Nitro-Chalk, applied at time of sowing.	Plot II. 20 tons Farm-yard manure 4 cwt. Super, 4 cwt. Kainit, 2 cwt. Sulphate of Ammonia applied at time of sowing.	Plot III. 20 tons Farm-yard manure 4 cwt. Super, 4 cwt. Kainit.	Plot IV. 20 tons Farm-yard manure 4 cwt. Super, 4 cwt. Kainit, 298 lbs. Nitro-Chalk (Top-dressing).	Plot V. 20 tons Farm-yard manure 4 cwt. Super, 4 cwt. Kainit, 298 lb. Nitrate of Soda (Top-dressing)
		T. C.	T. C.	T. C.	T. C.	T. C.
Carlow ...	Clay loam ...	32 0	35 17	26 8	28 10	33 11
Cavan ...	Deep friable loam	19 9	19 9	15 9	16 0	20 0
Clare ...	Rich loam ...	41 3	43 5	40 14	41 8	43 0
,, ...	Red loam ...	39 0	38 1	35 9	38 11	41 10
Cork ...	Medium sand-stone loam.	30 15	28 10	28 1	31 1	34 7
,, ...	Medium sand-stone loam.	36 9	30 15	27 2	30 3	37 12
,, ...	Heavy loam ...	39 11	41 17	34 11	39 17	40 14
,, ...	Medium loam (limestone).	46 10	46 9	45 1	49 3	52 17
,, ...	Sandy loam ...	35 16	38 4	27 19	33 12	35 15
Donegal ...	Peat ...	31 6	32 3	26 12	31 14	35 0
Dublin ...	Clay loam ...	41 0	38 1	35 13	43 1	39 14
Galway ...	Medium lime-stone loam.	34 10	34 10	33 0	36 2	37 2
Kerry ...	Light loam ...	33 6	35 2	32 6	34 5	33 6
Kildare ...	Deep loam ...	34 16	34 19	28 5	31 18	33 8
Kilkenny ...	Medium loam	32 3	30 16	25 7	27 10	31 0
Laoighis ...	Medium loam	30 0	28 3	25 5	26 8	27 17
Leitrim ...	Peaty ...	24 16	25 0	24 4	25 16	26 4
Limerick, E. ...	Limestone loam	36 7	34 18	27 15	32 13	29 0
Limerick, W. ...	Heavy limestone loam	42 6	48 12	37 13	41 14	46 9
Longford ...	Medium loam	35 12	38 11	34 1	35 3	38 1
Louth ...	Sandy loam ...	40 13	38 9	37 0	37 4	38 6
Mayo ...	Strong loam ...	35 10	36 5	32 0	37 0	36 15
,, ...	Rich loam ...	40 5	43 8	31 10	40 5	40 15
Monaghan ...	Loam ...	33 15	34 8	28 16	34 0	35 2
Offaly ...	Light loam ...	30 0	31 15	29 12	30 0	34 0
Roscommon, N.	Peaty ...	28 10	27 5	25 0	27 6	28 0
,, S.	Light medium loam	22 7	23 17	19 2	24 11	21 14
Sligo ...	Rich medium loam	42 0	41 8	40 17	42 3	46 5
Tipperary, N.	Rich clay loam	29 6	31 9	26 3	30 6	28 12
,, S. ...	Heavy clay ...	38 10	37 0	30 10	33 0	35 14
Waterford ...	Deep sandy loam	41 7	40 15	32 0	36 16	38 15
Westmeath ...	Heavy loam ...	40 4	39 0	38 7	39 0	44 5
Wexford ...	Loam ...	54 0	50 10	43 0	43 0	50 0
Wicklow ...	Deep loam ...	35 11	34 18	25 18	30 4	29 15
Average yield per Statute Acre (34 Centres) ...		35 11	35 13	31 4	34 2	35 14

TABLE VI.

County.	Character of Soil.	Manures Applied and Yields obtained per Statute Acre.									
		Plot I. 4 cwt. Super, 3 cwt. Kainit, 149 lb. Nitro-Chalk applied at time of sowing.		Plot II. 4 cwt. Super, 3 cwt. Kainit, 112 lb. Sulphate of Ammonia applied at time of sowing.		Plot III. 4 cwt. Super, 3 cwt. Kainit,		Plot IV. 4 cwt. Super, 3 cwt. Kainit, (at sowing), 149 lb. Nitro-Chalk applied as a Top-dressing.		Plot V. 4 cwt. Super, 3 cwt. Kainit, 149 lb. Nitrate of Soda applied as a Top-dressing.	
		T.	C.	T.	C.	T.	C.	T.	C.	T.	C.
Carlow ...	Medium loam, Moory type.	39	4	41	16	38	11	45	0	44	16
Cavan ...	Deep loam ...	35	9	30	18	29	18	28	12	31	9
Clare ...	Medium loam	23	11	24	0	20	18	25	8	23	10
,, ...	Light loam ...	—		—		—		—		—	
Cork ...	Clay loam ...	25	3	23	2	22	3	31	1	30	3
,, ...	Clay loam ...	24	16	23	2	22	17	25	18	26	1
,, ...	Heavy deep loam	30	9	28	12	27	17	27	14	28	14
,, ...	Medium limestone loam	33	4	29	0	28	4	34	10	32	14
Donegal ...	Med. loam with mix. of peat, slightly acid	30	0	28	0	23	4	30	15	29	6
Dublin ...	Clay loam ...	18	5	17	19	14	9	18	6	18	5
Kerry ...	Heavy loam ...	17	3	18	6	14	6	16	8	16	11
Kildare ...	Loam ...	22	12	23	8	18	14	21	14	21	8
Kilkenny ...	Medium loam	31	3	33	0	30	14	32	16	29	15
Laoighis ...	Light loam ...	20	4	18	8	17	14	19	14	18	14
Leitrim ...	Light peaty ...	23	15	24	10	22	0	22	10	22	18
Limerick ...	Heavy loam ...	32	14	29	16	22	10	27	6	29	16
,, ...	Limestone loam	22	12	25	10	19	10	22	6	19	5
Longford ...	Medium loam	39	10	40	2	38	11	40	17	41	0
Mayo ...	Deep loam ...	—		—		—		—		—	
,, ...	Clay loam ...	29	8	29	10	23	10	29	10	29	12
Monaghan ...	Sandy loam ...	33	4	34	3	30	2	33	6	32	8
Offaly ...	Sandy loam ...	24	3	23	13	23	2	24	3	23	6
Roscommon ...	Light sandy loam	19	7	21	2	17	1	20	2	20	11
,, ...	Peaty ...	23	10	22	0	20	12	21	6	20	16
Sligo ...	Medium loam	39	3	30	6	25	14	30	12	29	15
Tipperary, N.R.	Clay loam ...	18	13	18	0	17	14	19	14	18	6
,, S.R.	Medium clay ...	31	0	32	3	27	17	29	0	31	4
Waterford ...	Drift loam ...	28	18	28	6	27	6	29	7	29	2
Westmeath ...	Heavy loam ...	27	1	26	13	23	4	27	0	25	8
Wicklow ...	Deep loam ...	30	12	30	17	29	10	30	10	30	0
Average Yield per Statute Acre (28 Centres) ...		27	2	27	0	24	4	27	6	26	19

III.—THE MANURING OF PASTURE.

Phosphates.

During the three seasons 1922-24 a series of demonstrations with different types of phosphatic manures—Basic Slag, Peerless, and two brands of ground North African Mineral phosphates—were laid down on poor pasture lands by the Assistant Agricultural Overseers at over one hundred and

thirty centres in the congested areas. The manures were applied at all centres at the rate of 8 cwt. per statute acre, and in the majority of cases the lands on which the demonstrations were located had not for a number of years previously received manure. During the first, second and third seasons following application each of the phosphates produced a distinct improvement in the quality and quantity of the herbage on the pasture; the best results were, however, obtained on the plots to which Basic Slag and Peerless phosphate were applied. After the third season the Peerless phosphate began to show signs of becoming exhausted and the results obtained from this phosphate became less distinct each season afterwards until in 1929 practically no benefit was noticeable at over half the centres at which this manure had been applied. Basic Slag continued to produce good results over a much longer period than the Peerless phosphate, but after the fifth season the results from this manure were not equal to those produced by the North African mineral phosphates, both of which gave similar returns. Although these mineral phosphates did not, during the years immediately following application, produce such noticeable results as Basic Slag or Peerless phosphate, they have continued to be effective at over ninety per cent. of the centres even after a lapse of six or seven years.

Another series of demonstrations on the top dressing of poor pasture land with different phosphatic manures at the rate of 8 cwt. per statute acre was begun by the Agricultural Overseers in 1926. At about two-thirds of the centres Semsol was compared with Clare phosphate. At the remaining centres Clare phosphate and North African mineral phosphates were applied to similar plots. In the season in which these manures were applied and in the two following seasons both Semsol and North African mineral phosphate produced a distinct improvement in the pastures to which they were applied. Except at a few centres, mostly on peaty soils, Clare phosphate failed to give any appreciable return. Reports on the appearance of the pasture during the fourth season (1929) indicate that Semsol and North African mineral phosphate still continue to produce a marked improvement in the quality of the pasture at over 90 per cent. of the centres at which they were applied. The Clare phosphate produced results equally as good as Semsol or North African mineral phosphate at about 11 per cent. of the centres at which trials were conducted. A slight improvement was noticeable at 13 per cent. of the centres, but at the remaining centres no noticeable improvement resulted from the application of Clare phosphate. At most of the centres where Clare phosphate produced good results the soil was of a wet, peaty, nature.

A further series of trials on the manuring of pasture land was laid down by the Assistant Overseers in 1927 at a large number of centres. The manures included were Semsol, North African mineral phosphates and Clare phosphate, all applied at the rate of 8 cwt. per statute acre. In the season in which the manures were applied satisfactory results were obtained from Semsol and North African mineral phosphate. The latter, however, did not produce results as early in the season as did Semsol. The returns from the Clare

phosphates were unsatisfactory. In 1928 the results obtained where Semsol was applied were again outstanding and those from the North African mineral phosphate were almost equally good. Clare phosphate, however, failed to produce any appreciable improvement except at a few centres where the soil was wet and boggy. During the past season the improvement already observed on the plots dressed with Semsol and North African mineral phosphate was maintained, except at one centre where the latter failed to produce any improvement. At about 80 per cent. of the centres there was no visible improvement in the pasture on the plots to which Clare phosphate had been applied. At the remaining 20 per cent. of the centres an improvement in the pasture was noticeable, and at about one-third of these latter centres, mostly on peaty soils, the pasture on the plots dressed with Clare phosphates was said to be equally as good as that on those dressed with either Semsol or North African mineral phosphate.

Phosphates and Lime.

In the early Spring of 1925 a series of trials on grassland with Basic Slag, Semsol, North African mineral phosphate, burnt lime, and ground limestone, were laid down by Agricultural Instructors at a number of centres throughout the Saorstát. The phosphates were, in all cases, applied at the rate of 6 cwt., the burnt lime at the rate of 1 to $1\frac{1}{2}$ tons, and the ground limestone at the rate of 3 tons per statute acre. A similar series of experiments was also laid down in the Spring of 1926.

In the first and second seasons all the phosphatic manures effected a distinct improvement in the pasture to which they were applied. North African mineral phosphate did not, during these two seasons, produce as early a growth or as distinct an improvement as Basic Slag or Semsol, the returns from which were about equal. Both burnt lime and ground limestone, except at a very limited number of centres, failed to produce any noticeable benefit.

In the third season Basic Slag continued to produce remarkably good results, while Semsol appeared to be slightly less effective, and North African mineral phosphate more effective than in the previous seasons. At about half the centres at which burnt lime or ground limestone was applied no improvement in the pasture was observed, while at most of the remaining centres the benefits derived from the dressings of lime were small compared with those produced by the phosphate manures. Only in one or two cases was any appreciable improvement noticeable where burnt lime or ground limestone had been applied.

In the fourth season it was reported that Basic Slag and Semsol, although slightly less effective than in the previous season, still continued to give good results and that North African mineral phosphate gave practically equal returns. It was only in a very few cases that any appreciable improvement in the pasture was noticed where burnt lime or ground limestone had been applied.

Reports received towards the end of 1929 from a number of centres where these trials were laid down in 1925 indicate that during the fifth season after application the phosphatic manures continue to produce good results at the majority of the centres and that neither burnt lime nor ground limestone appear to improve the pasture to any appreciable extent. In the fifth season, however, the North African mineral phosphate gave better results than either Basic Slag or Semsol, both of which, particularly the Semsol, appeared to be showing signs of becoming exhausted in the soil.

At only about half the centres did the pasture on the plots dressed with burnt lime or ground limestone show any signs of improvement, and it was only at one centre that the improvement compared favourably with that brought about from the applications of the phosphatic manures.

Phosphates and Potash.

It has been clearly demonstrated in this country that phosphates are the basis of grassland manuring and that, on most soils, remarkable improvement can be brought about by the application of even a comparatively light dressing of a suitable phosphatic manure. Until recently, however, relatively little information was available as to the influence of potash when applied as a supplement to phosphates on pasture land. In the Winter of 1927-28 arrangements were made by the Agricultural Instructors for the conduct of a series of top dressing trials on grassland with phosphates alone and phosphates supplemented by potash. One plot at each centre was top dressed completely with a phosphatic manure. One half of the plot so treated was then dressed with kainit at the rate of 3 cwt. per statute acre. The same type of phosphatic manure was not used at all centres, basic slag, semsol, or North African mineral phosphate at rates varying from four to eight cwt. per statute acre being used at most centres. Trials were conducted on a great variety of soils at over four hundred centres.

In the season in which the manures were applied the pasture on the plots dressed with phosphates alone and with phosphates and potash showed a considerable improvement as regards earliness of growth, development of clovers and general appearance compared with the unmanured portion of the pasture. From about one-third of the centres it was reported that the pasture on the plots treated with both phosphates and potash presented a somewhat better appearance and appeared to contain more clovers than the pasture on the portion of the plot dressed with phosphates only. At no centre, however, was there any outstanding difference between the manured plots. At the remaining centres at which trials were conducted no difference could be observed between the pasture on the area treated with phosphates and that on the portion dressed with both phosphates and potash.

Towards the end of 1929 reports were received from 358 of the centres where trials were laid down in the previous year. The improvement in the pasture resulting from the application of phosphates noted in the season in

which the manures were applied was well maintained at almost all centres during the second season. At about 40 per cent. of the centres it was observed that the pasture on the plots to which both potash and phosphates were applied commenced growth somewhat earlier in the Spring and appeared to contain more clovers than that on the corresponding plots dressed with phosphates alone. It was only at fourteen of these centres, however, that the addition of potash produced a marked improvement. At the remaining centres no difference in the appearance of the pasture on the plots dressed with phosphates alone and on those treated with phosphates and potash could be detected.

The results of these trials up to the end of the second season appear to indicate that on many soils little extra benefit is likely to accrue from the use of kainit as a supplement to phosphatic manures in the manuring of grasslands. It is evident, however, that on some soils the addition of potash to phosphates results in the production of a better pasture than where phosphatic manures alone are employed. Since the evidence available does not afford any information as to the types of soil on which potash, in addition to phosphates, is likely to prove profitable farmers who contemplate using potash on an extensive scale for the manuring of pasture would be well advised to arrange for a preliminary small scale trial on their own land.

The "New System" of Grassland Manuring and Management.

In the report on Field Experiments, 1928, published in the Department's Journal, Volume XXVIII., No. 2, the "Hohenheim" or "New System" of grassland management was fully described and the results of the trials conducted by Agricultural Instructors at 28 centres throughout the Saorstát during the season of 1928 were set out. These trials were continued during the past season at 24 centres. At four centres the tests were discontinued, but new trials were laid down at four other centres. As in the previous season a basal dressing of phosphates and potash was applied at all centres in early Spring. In addition, in all cases, at least one dressing of sulphate of ammonia was applied early in the season. At eight centres a second application of sulphate of ammonia was given about the month of May, while at nine centres a third dressing was applied about August.

As in the previous season the outstanding feature in connection with these trials was the early growth of grass on the treated plots. In practically all cases they were ready for grazing from a fortnight to three weeks before similar adjoining pastures which had not been manured. The Spring and Summer of 1929 were comparatively dry and therefore not conducive to the growth of herbage. During the very dry period in the month of July the herbage on the plots, particularly at those centres where the land was heavily stocked, became dry and parched and in some cases it was found necessary to remove the stock off the plots for a fortnight or so. Following on the short rest-period the pasture at almost all centres recovered

rapidly and grazed well throughout the remainder of the season. At other centres where the plots were not stocked to maximum capacity during the very dry spells ample pasturage was available even during the dry periods of the Summer.

At most centres little apparent benefit appears to have been derived from the third dressing of nitrogenous manure applied in the early Autumn and in a few cases the improvement in the growth of herbage resulting from the second application was slight. In every case, however, the initial application of sulphate of ammonia applied in addition to the basal dressing produced a remarkable improvement in the pasture both as regards earliness of growth and bulk of herbage.

Records of the quantities of manures applied, the dates of application, the numbers and kinds of stock grazed on the plots, and the quantity of milk produced, at centres where dairy stock were grazed, were kept at all centres and these particulars have been incorporated in the reports on the trials already published in the annual reports issued by the County Committees of Agriculture.

ARTERIAL DRAINAGE WITH SOME REFERENCE TO THE RIVER BARROW.

By J. Chaloner Smith, D.Sc., M.Inst. C.E.I., Engineer in Charge, Barrow Drainage for the Commissioners of Public Works.

At the outset it is well to define the term "Arterial drainage" pointing out what it should include and indicating the matters which lie outside its scope.

In the case of a large river like the Barrow which drains about 400,000 acres down to Athy the object of an arterial drainage scheme is to execute works along the course of the main river and its larger tributaries to provide discharge capacity sufficient to prevent prolonged inundation and saturation of the lands affected. In other words the object is to provide improved outlet capacity in the arterial network of the main river and its tributaries.

Arterial drainage does not include within its scope works for the betterment of the lands to which improved outlet facilities have been given. Works of this nature are generally referred to as "land drainage" or "thorough drainage" and as a general rule follow on after the arterial drainage works are complete.

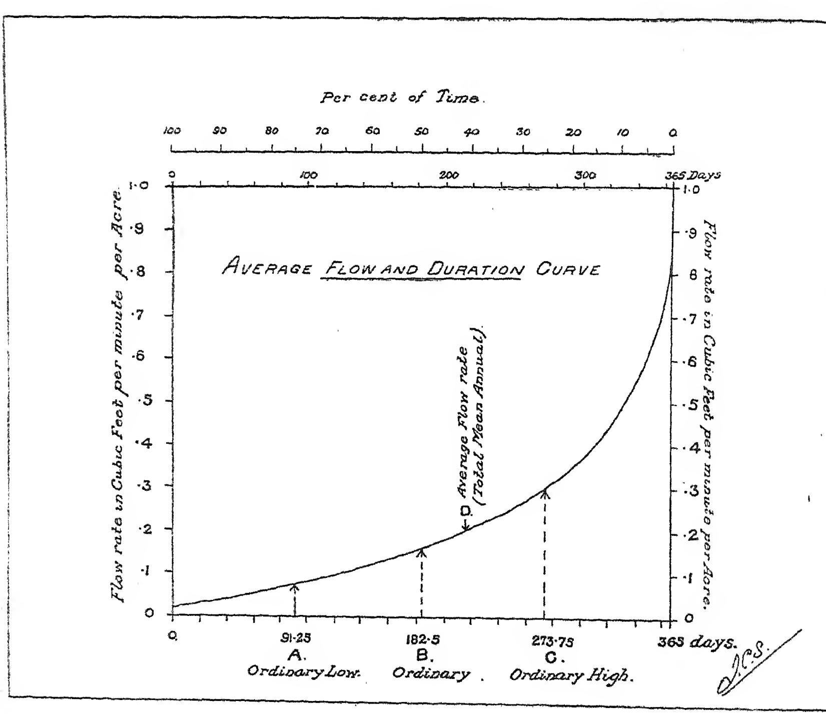
It would be quite possible to execute a well designed system of arterial drainage in a river basin which would produce little beneficial result if the opportunity to take advantage of the improved outlet conditions was neglected by the occupiers of the lands affected, much in the same way as it would be possible to provide an elaborate system of main sewers in a large town with little benefit to the general health and well being of the inhabitants if the householders neglected their opportunity to connect their dwellings up with the main drainage system. Illustrations such as these are merely intended to show that the full benefit of a well considered arterial drainage scheme cannot be realised unless it is followed by thorough drainage afterwards and unless both the primary and secondary drainage systems are at all times carefully maintained in efficient operation.

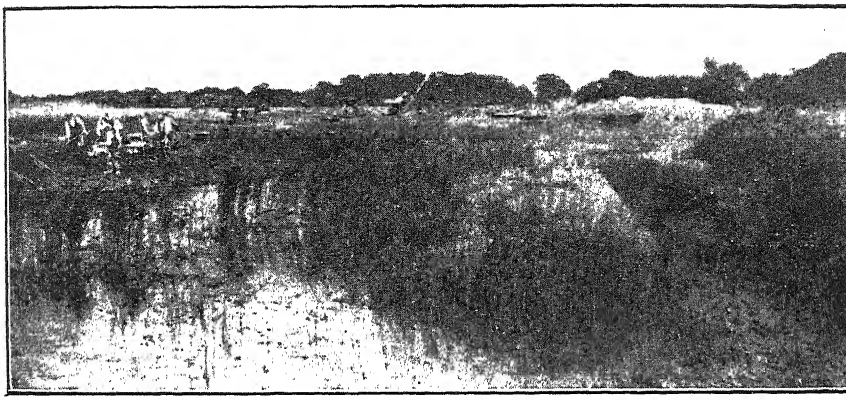
In the discussion of most arterial drainage proposals of any considerable extent it is necessary to be clear as to the distinction between "drainage" and "flood prevention." In this distinction may lie the difference between an economic and an uneconomic scheme. Experience has shown that in a state of nature most of our larger rivers and streams are unable to discharge a greater volume of flow than the average without flooding and saturation occurring at various points along their courses. The average volume of flow may be defined as the mean of the daily flow rates measured at some point near the outlet of the rain basin over a long series of years. The value so obtained is generally referred to as the "Total Mean Annual Flow," and for our Irish rivers having rain basins not less than about 50 Sq. Miles in area

it may be estimated as being about ·2 Cu. ft. p. min. p. acre. This value may vary slightly in accordance with the average rainfall of the district and may be slightly more on the Western side of the country and slightly less on the Eastern, but for a general statement the figure is near enough to the truth. Again experience has shown that in a year in which the rain fall conditions are about the average the flow in the river will be below its Total Mean Annual Value for more than half of the time and above it for less than half of the time, the actual average periods expressed in days being about 217 below and 148 above.

If over a long series of years the daily flow rates as measured at some given point near the outlet are set out in ascending order year by year, from the lowest to the highest in each separate year, a series of irregular curves will result, and if an average curve of these is drawn with the average flow rates plotted as ordinates on a time scale of 365 days it will be found that by reading to the average curve from the time scale at 91.25 days, 182.5 days, and 273.75 days, say points A B and C, the resulting flow values will bear the following relationship to each other, viz.: that A will be about half of B (the mid-point) and C will be about double B, and these values are generally referred to as the Ordinary Low, Ordinary or Mid-point, and Ordinary High Flows. The midpoint B reading will be less than the value of the Total Mean Annual flow already referred to.

The whole of this general statement may be clearly set out in the form of a diagram.

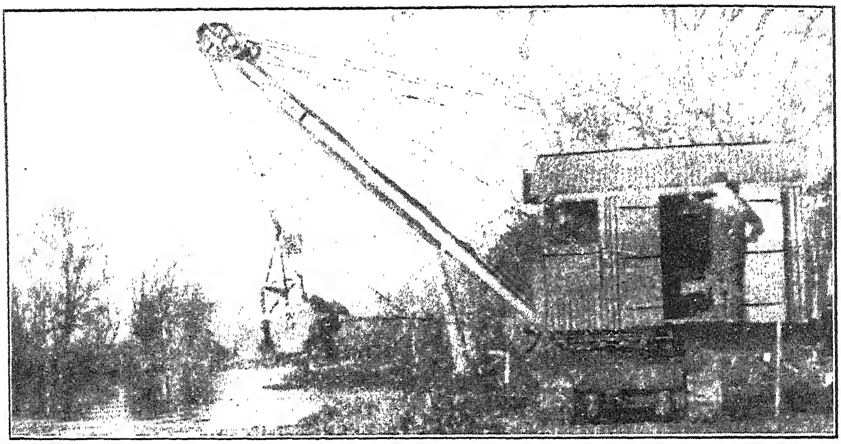




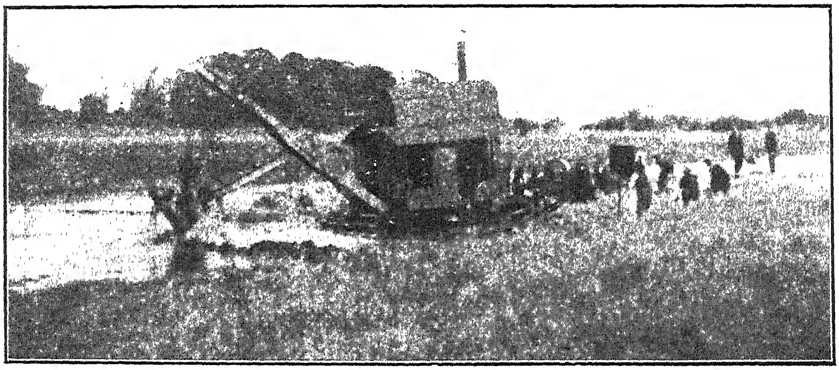
Ballymanus—Right Channel before Clearing.

Ballymanus—Right Channel Cleared.

Above Millgrove Weir, Figile River, untouched upstream.

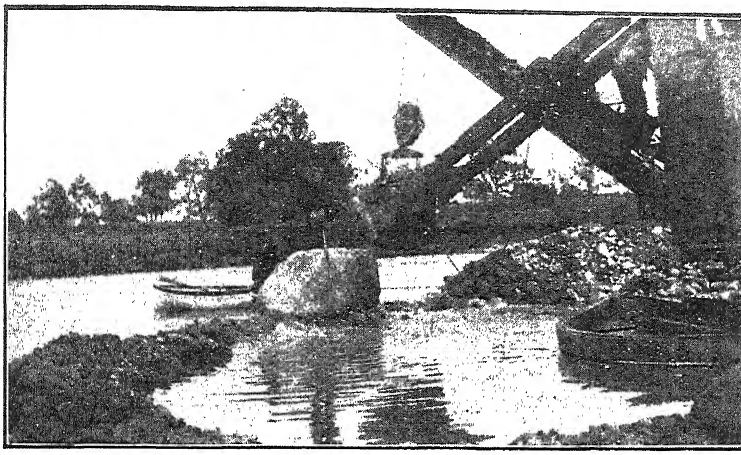


Monasterevin—Ruston No. 4 Drag-line working near Sallow Island—Looking upstream.

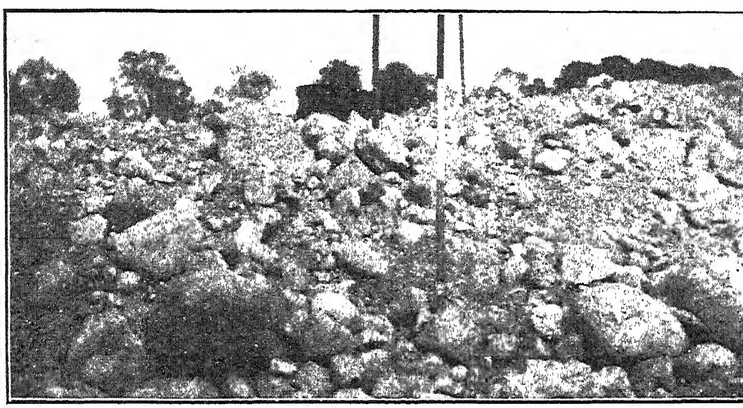


Near. Cardington House—Priestman Navvy.

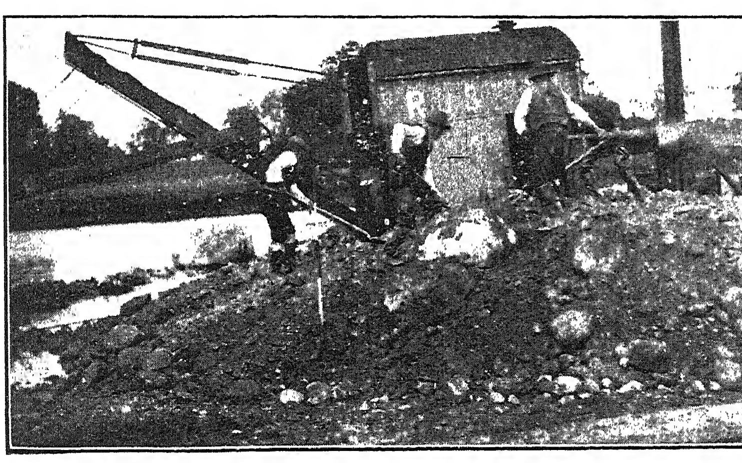
Below Portlarlington. In Mr. Odlum's Demesne. Looking upstream.



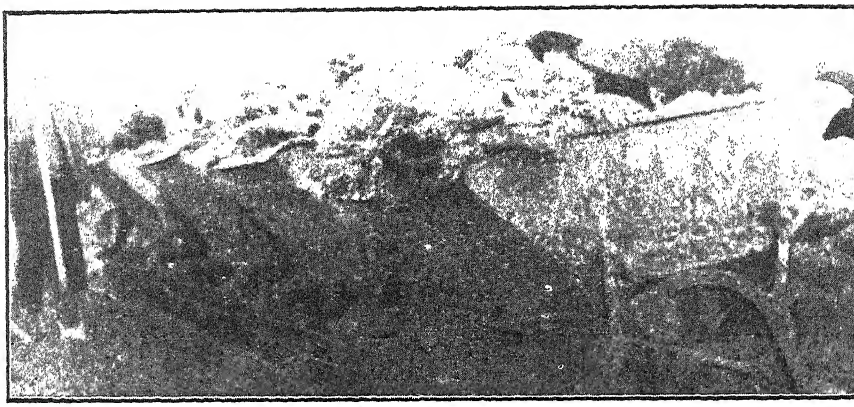
Near Cardington House—No. 6 II. Ruston in Boulder Clay.



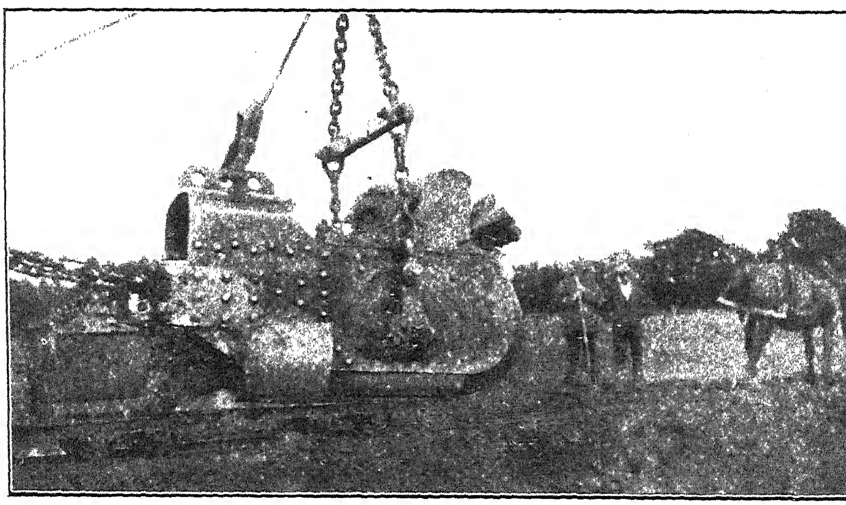
Near Cardington House—Boulder Clay dug by Ruston No. 6 II.



Near Cardington House—No. 6 II. Ruston in Boulder Clay.



Monasterevin—Waggoning Blue Steep at Sallow Island.



Monasterevin—Working the Blue Steep at Sallow Island.

Milford Weir (below Carlow) before Clearing.

A curve of this nature is referred to as a " Flow and Duration Curve," and it is useful in the discussion of arterial drainage and other problems as it takes into consideration the time percentages during which stated flows may be expected to prevail on the average.

It must be remembered, however, that it deals only with averages, and that flow and duration in an individual year may differ widely from the average either in excess or defect.

To take a case : let it be supposed that in a large river flooding begins along the main and tributary channels when the flow reaches about .2 Cu. ft. p. Min. p. Acre towards the outlet and that owing to obstructions in the channel the flood water can only escape slowly and lies on the inundated lands for weeks and months at a time. Let it further be supposed that at long intervals, say twice or thrice in a century, there is evidence that the flood discharge at some given point near the outlet reached or exceeded four times the average rate at which flooding begins, or say that it rose to .8 Cu. ft. p. min. p. Acre, which would be a very severe flood indeed from a catchment of any considerable area. In such a case if a scheme were called for with the object of ensuring that the lands should never again be inundated the problem becomes one of flood prevention, but one in which it would not be sufficient to design the works to provide for a flow rate of .8 Cu. ft. p. Min. p. Acre running off below the level of the adjacent lands as something must be added to provide against the chance of a worse flood than the worst known occurring at any time. Consequently the engineer responsible for the design would provide for a discharge of 1 Cu. ft. p. Min. p. Acre, or even more than this so as to be on the safe side.

Without labouring the point, in the vast majority of cases these conditions would imply that the cost of the works would far exceed the fee simple of the lands to be improved under the scheme, and that therefore any such " flood prevention scheme " would be hopelessly uneconomic from the start.

A reference to the average Flow and Duration diagram will show that the time percentage during which a flow of .8 Cu. ft. p. Min. p. Acre may be expected to prevail is negligible.

It seems possible, however, that a thoroughly sound arterial drainage scheme might be provided in the assumed case if the aim is directed to " drainage " as against " flood prevention."

From the " drainage " point of view alone there is a wide choice of alternatives any one of which would produce benefit so far as drainage is concerned.

To take the least of these which might be expected to produce a marked improvement in the drainage conditions let it be assumed that the scope of the scheme be no more than to carry out such works as would enable the average flow rate of .2 Cu. ft. p. Min. p. Acre to be discharged below the level of the affected lands, but without any attempt to provide increased discharge capacity in excess of this requirement. A scheme of no more extended scope than this, if skilfully executed, would probably have the result of very considerably diminishing the time percentage during which flood water lay

out on the lands, and would also bring about a lowering of the sub-soil water level, which in the long run would react favourably on the vegetation on the affected lands.

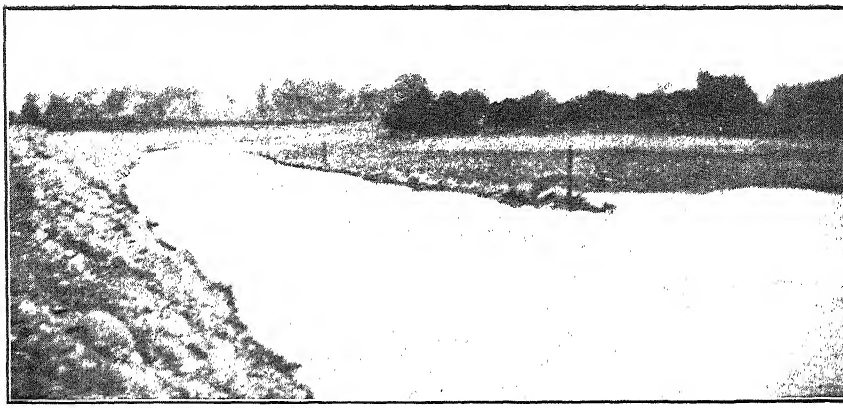
Next in order would be a scheme embracing increased discharge capacity in the channels. Let it be supposed that its object is to provide for the discharge of the Ordinary High stage of flow below the general level of the lands affected, or say for a flow rate of .3 Cu. ft. p. Min. p. Acre near the outlet of the rain basin. Here again there would be a further diminution in the time percentage during which floods might be expected to lie out on the affected lands, a further lowering of the adjacent sub-soil water levels, and an increased improvement in the vegetation on the lands affected, but of course, necessarily involving an increased estimate of cost. The scope of the scheme can be increased in this manner step by step, each increase in the discharge capacity implying a corresponding increase in the estimate and the cost per acre of the scheme on the lands affected.

The economic limit seems to be reached if the scheme provides for passing about .5 Cu. ft. p. Min. p. Acre below the level of the affected lands near the outlet to the rain basin.

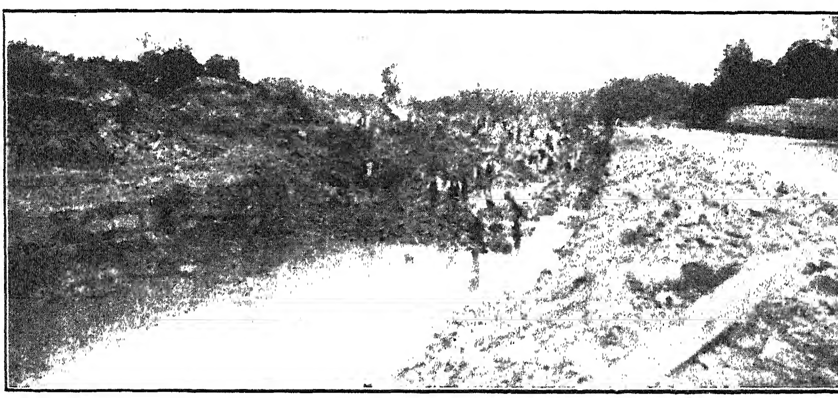
It cannot be too much emphasised that a scheme of this kind will not prevent occasional loss and damage by flooding at certain critical times of the year such as Spring and Harvest. Winter floods, provided that they do not lie too long on the lands, do not seem to do much harm, but it occasionally happens that a Harvest flood occurs approaching in volume of flow that of a severe Winter flood. Fortunately such an occurrence is rare, and, as a general rule, severe Harvest floods run about .5 Cu. ft. p. Min. p. Acre and severe Winter floods about .7 Cu. ft. p. Min. p. Acre, but from the point of view of damage the former are much more to be feared than the latter. This risk of occasional loss by flooding is one of the main arguments against the execution of arterial drainage upon a moderate scale, and land valuers, as a rule, are reluctant to assess at anything but a low rate lands which although relieved of almost perennial flooding are still liable to occasional flooding in abnormal conditions.

The steadiness of the general average rainfall of Ireland and the smallness of its mean deviation from the average has been well shown by the late Mr. Carle Salter in his book on "The Rainfall of the British Isles" published in 1921. Taking Ireland as a whole he shows that the general rainfall 1865-1919 is 43.8 inches, that in the wettest year of the 55 year period the rainfall was 54.4 inches, or 124 per cent. of the average, and in the driest year 33.7 inches, or 77 per cent. of the average, and that the mean deviation from the average of the period is 2.8 inches, or 6.4 per cent.

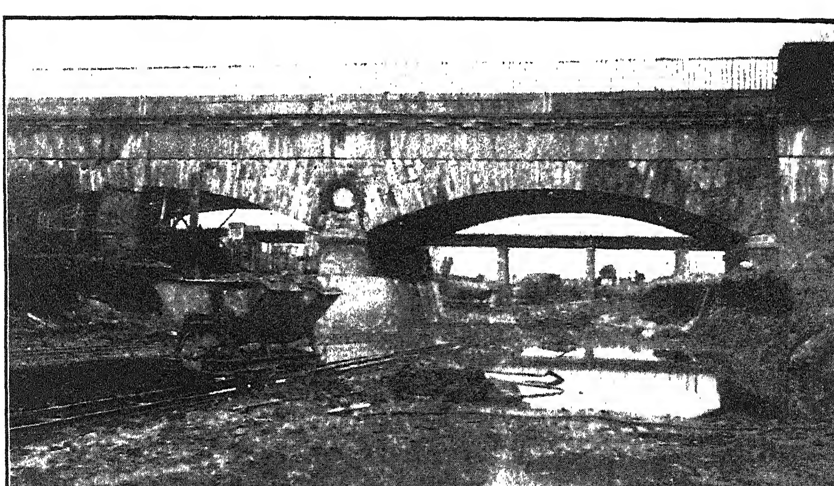
Facts such as these appear to support the argument that in arterial drainage provision for passing little more than the ordinary high stage flows below the level of the lands affected and leaving abnormal stages of flow to look after themselves would in general be sufficient to effect a great improvement. In the matter of assessments on the improved value resulting from schemes of this kind more regard should be paid to the great increase in time during which the lands are freed from inundation and saturation by the lowering



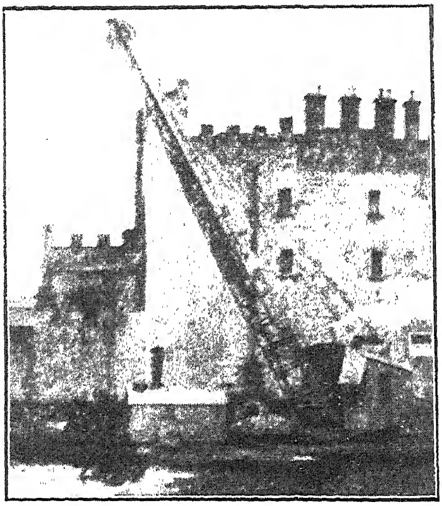
Toberara—Single cut taking the entire flow of river upstream.



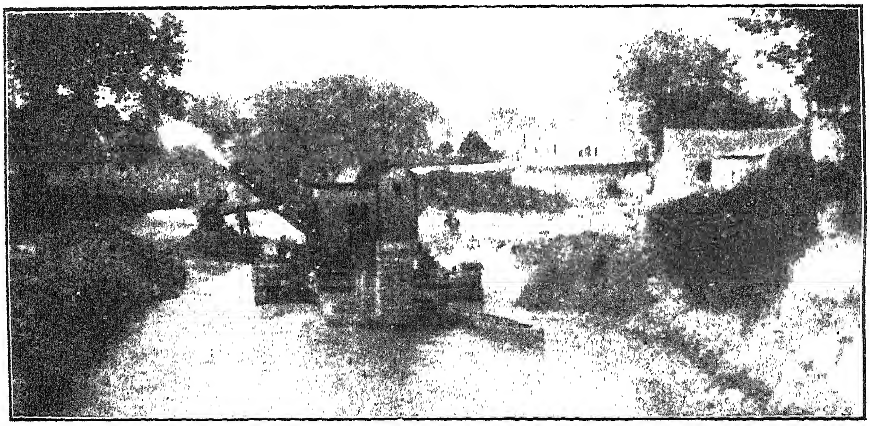
Bert Rock Cutting, looking upstream.



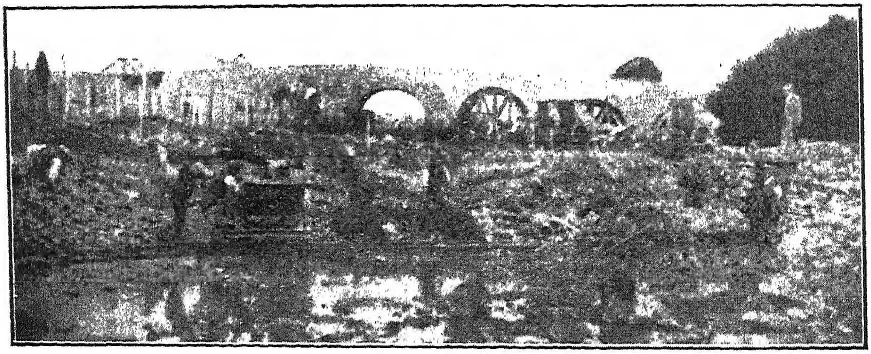
Monasterevin—Aqueduct, looking upstream, left bank.



Priestman No. 30A. Long jib crane clearing arches, Crom-a-boo Bridge.



Monasterevin—Ruston Navvy above Town Bridge, looking upstream.



Monasterevin—Rock cutting, looking upstream towards Pass Bridge, left bank.

of the surface water and sub-soil water levels than to the fact that at long intervals an abnormal flood may inundate them for a few days in Winter. It makes a bigger difference to a riparian occupier than is represented by a shilling or two per acre, whether, under existing conditions, he is able to save a crop of coarse and inferior hay say once in five years, or, whether, as a result of arterial drainage, he saves a crop of good hay every year except, perhaps, one in twenty five.

In the case of the Barrow River the catchment area above Athy, about 400,000 st. acres in area, is generally flat except for one small hilly district in its western extremity. Of this area roughly about 24,000 acres are inundated for longer or shorter periods each year and about 24,000 acres more saturated and water logged. These affected lands are distributed generally along the lines of the main water-courses.

The main river and tributary water courses have quite sufficient fall for drainage purposes, but the condition of these channels, blocked as they are by obstructions of all kinds, natural and artificial, has hitherto prevented the available fall being utilised for drainage and has resulted in constant inundation and injury to the lands.

Below Athy and downwards to the tidal water at St. Mullins the Barrow is confined to a more or less narrow valley along which the flooding is not serious, not more than about 1,000 acres of land being affected to which only a limited degree of relief can be given on account of the series of navigation weirs in the river and the general neglect of its maintenance as a channel of discharge.

After numerous efforts during the past eighty years to obtain Parliamentary powers for the execution of a scheme for the drainage of the Barrow River, all of which from one cause or another came to nothing, it remained for the present Government of the Irish Free State to pass the Barrow Drainage Act in May, 1927, and to start the works.

Under the present scheme, starting from a point about two miles below Athy the main river will be deepened and widened upwards through the towns of Athy, Monasterevan, and Portarlington to Ballyclare Bridge near Rosenallis in Laoighis on the northern slopes of the Slieve Bloom Mountains. In addition to the work on the main river the arterial drainage operations will be carried up ten of the main tributaries to a total length of about seventy-four miles.

The actual work itself is practically confined to excavation from the existing river beds to such gradients and depths as will provide for the discharge of a severe flood below the level of the lands affected. There is no attempt under the present scheme to provide immunity against abnormal floods, but nevertheless the scope of the scheme so far as discharge capacity near the outlet is concerned is in excess of that referred to in the foregoing general discussion as the "economic limit," viz.: .5 Cu. ft. p. Min. p. Acre. The present scheme provides at the outlet for a discharge capacity of about .6 Cu. ft. P. Min. P. Acre running off below the level of the lands.

At this point it may be well to explain that the term "discharge capacity at the outlet" does not imply that that rate of discharge is uniform all over the catchment area and that the discharge capacities of the various channels

high up in the catchment are calculated on that assumption. It is well known that the flow rate per unit of area at the outlet of a large catchment may increase as one proceeds upwards along the main river towards the source, and similarly with the tributaries. Thus in a carefully designed scheme the flow rates on which the discharge capacity of the channels are based will show a progressive increase from the outlet upwards. How much this increase may amount to depends on several factors such as the size and shape of the catchment, the general slope of the ground, the rainfall, and so forth. To provide discharge capacity for the tributary network high up in a large catchment where the ground may be hilly, the rainfall high, and the value of the lands occasionally inundated not particularly great, so that floods would pass off below the level of the lands, might easily mean providing channels for the discharge of two or three cubic feet p. minute p. acre, or even more. In the case of the River Barrow many schemes have been proposed ranging in scope from a mere clearing up which might pass the average flow below the level of the lands to an absolute " flood prevention " scheme.

The estimated costs of these extremes might be put at £50,000 for the former, and £1,250,000 for the latter. The estimated cost of the scheme at present in course of execution is £425,000, which possibly represents something near the limit of justifiable expenditure on a work of the kind. In the case of the River Barrow there were special reasons to justify an expenditure in excess of the strict economic limit, which may roughly be defined as the capitalised value of the assessments on the improved lands. For more than eighty years proposals had been brought forward one after the other for the drainage of the district, all of which came to nothing: the inhabitants of the affected areas had suffered losses in health, comfort, and pocket which it would be difficult to form any idea of without having walked through the affected areas in Spring when the floods which had lain on the lands all the Winter had just passed off leaving the lands strewn with rotting black slime which was all that was left of the last season's hay crop. It is hardly to be wondered at that even after the works had actually begun, many people, in the face of their previous disappointments, refused to believe that there was any serious intention of completing the work.

The actual works offer no problem of any special interest; about one and three quarter millions of Cubic Yards of " soft " material has to be excavated from the beds of the main river and tributaries to varying depths and widths, and about 80,000 Cubic yards of rock. County road bridges, railway viaducts, and canal aqueducts, etc., have to be underpinned or their foundations protected on account of the lowering of the stream beds. Mill weirs and eel weirs have to be removed and the owners compensated, but upon the whole it is a " digging " operation from first to last. The expression " soft excavation " is a comprehensive term and simply means that material has to be removed which is not actual rock. It may vary from clay of about the consistency of cream cheese to hard packed and calcreted gravel, or stiff clay with large boulders which has lain undisturbed since the last glaciation. From its position and nature the only economic method of taking out such excavation

is by machine, and consequently mechanical excavators have been employed in increasing numbers on the work almost from the start.

There are three types of excavating machines in use, viz.:—

(1) Dipper Dredgers,
(2) Drag-line excavators,
(3) Grabs.

In addition to these, extended use is made of drilling machines driven by compressed air, power driven pumps, etc., whilst in the depot at Athy where the headquarters and stores are, there are shops at which all the ordinary repairs to the plant are carried out, and where the pontoons for the floating plant, etc., are made.

The dipper-dredger is simply a steam navvy set afloat upon a pontoon. When moored head and stern to the banks on either side of her she can cut her own flotation. The grabs are worked from long jib cranes, also afloat, and can be used either for excavating to the required depth or for disposing of the spoil already won by the dipper dredgers.

The drag-line excavators can work from the banks, or from the tops of the spoil heaps, for excavating from the river bed or for spreading the spoil banks.

The accompanying photographs show the machines at work and give some indication of the variety of the material to be dealt with.

SEED PROPAGATION, 1929.

Report on the work of the Seed Propagation Division of the Department of Agriculture for 1929.

As in the previous season the propagation of parent stocks of barley was continued at the Department's Cereal Station at Ballinacurra, County Cork, and in addition extension work with oats, barley and wheat was continued under the Department's control. Propagation of parent stocks of wheat and oats was continued at the Albert Agricultural College, Glasnevin, under the supervision of the staff of the Agricultural Faculty of University College, Dublin. Particulars of the work conducted under the Department's control during the season of 1929 are embodied in this report, and an account of the work carried out at the Albert Agricultural College will be found elsewhere in this Journal.

Weather Conditions in 1929.

The weather preceding the sowing period was rather wet with little sunshine. Early in March, however, conditions improved and a dry spell with plenty of sunshine permitted sowing to be carried out in good condition. This dry period continued throughout the remainder of the Spring. The early summer was somewhat cold and although there was plenty of rain at first growth was somewhat slow. This was probably due to the lack of sunshine, which was a feature of the season. Cereals were slow in ripening but weather conditions during harvest time were unusually favourable and all crops were harvested in good condition. Fine weather persisted until well into October with the result that threshing operations were completed in good season.

BARLEY.

As in previous years the Department again had the close co-operation and assistance of Messrs. A. Guinness, Son & Company, Limited, in the work pertaining to the improvement of the barley crop.

With the object of preventing the occurrence of smut all seed used in the various cultivations or distributed from the Cereal Station was again treated with Abavit powder. The results were extremely satisfactory; no trace of smut being found in any of the crops resulting from the treated seed. Stripe Disease (Helminthosporium) was, however, very prevalent during the season of 1929 and practically all the cultivations, particularly those grown in the cage, were attacked.

1. Propagations.

(a) *Pure Lines and Hybrids.*

Sixty-six single plant selections were grown in the cereal cage at Ballinacurra. These consisted of all the best known varieties in cultivation, together with a number of untried hybrids and a few selections from old native varieties. Thirty-two garden plots in the Rosehill West Paddock and eighteen field plots in the Rosehill Cage Field were also grown.

(b) 1*st Pedigree.*

Plots of approximately one statute acre each of the following varieties were sown on the farm of Mrs. O'Brien, Loughatalia, Ballinacurra:—

Spratt-Archer 37/12/41, Spratt-Archer 37/17/52,
Spratt-Archer 37 No. 4, Archer-Goldthorpe-Spratt 3/3/3,
Archer, Spratt-Archer 37/6 x Goldthorpe-Spratt 18/1,
Abed Rex x Spratt-Archer 37/18 and July six rowed.

On the farm of Mr. C. Deasy, Loughatalia, a plot of about five statute acres of Spratt-Archer 37 No. 3 was grown.

(c) 2*nd Pedigree.*

A 2nd pedigree plot of Spratt-Archer 37 No. 4, of about 11½ statute acres was grown on the farm of Mr. R. J. Hegarty, Broomfield, Midleton, and 2nd pedigree plots of Spratt-Archer 37 No. 3 were grown on the following farms:—

C. Deasy, Loughatalia, Ballinacurra	2½ acres
P. MacCarthy, Castleredmond, Ballinacurra	6 ,,

With the object of providing a large stock of seed of Spratt-Archer 37 No. 3 for distribution to maltsters and others in the Spring of 1930, additional plots sown with the produce of the 1928 second pedigree cultivations were located on the following farms:—

J. O'Keeffe, Loughaderra, Castlemartyr	7 acres
Thos. Twomey, Ballintubber, Carrigtwohill	6 ,,
Con. Fitzgerald, Haymount, Midleton	12 ,,
Denis Mulcahy, Ballintubber, Carrigtwohill	8 ,,

Arrangements were made to have the produce of these plots reserved for seed purposes and where suitable distributed to maltsters and others under the Department's Scheme for the distribution of seed barley.

2.—Inspection of Growing Crops.

As in previous years, the Department arranged for the inspection of growing crops of Spratt-Archer with a view to ascertaining the suitability of the produce for seed purposes. These inspections were confined to the

crops grown from (a) seed obtained from Ballinacurra in 1929; (b) the produce of the seed obtained from Ballinacurra in 1928; and (c) commercial seed.

A total of approximately 5,020 statute acres was inspected, of which 144 acres were in class (a), 1,827 acres in class (b) and 3,047 acres in class (c). Of these 1.4% were rejected for seed purposes in class (a), 9.4% in class (b), and 41.1% in class (c). Although the acreage inspected was greater than that inspected in 1928, the percentage of crops rejected as unsuitable for the production of seed was considerably less than in the previous year. In the crops grown from seed sent out from the Cereal Station at Ballinacurra in the Spring of 1929 not a single ear of smutted barley was noticed. This, no doubt, is mainly attributable to the fact that all seed was treated with Abavit powder prior to despatch from the cereal station.

3.—Large Scale Variety Experiments.

Large scale variety tests were conducted at the centres as shown in tables I. and II. The varieties compared were as follows:—

Spratt-Archer 37/6.
Spratt-Archer 37 No. 3.
Spratt-Archer 37 No. 4.
A. G. S. 3/3/3.
Old Irish.
July Six-Rowed.

The two last named varieties were grown at only one centre each, the other varieties being included in the trials at all centres.

Four of the centres were located in County Wexford and one each in the Counties of Offaly, Cork, Tipperary, Laoighis, Kildare and Louth. The area of each plot was one statute acre, except at one of the County Wexford centres, where the plots were each ¾ acre in extent.

The seed of Spratt Archer 37/6 used in these trials was drawn from a stock of this variety obtained from New Ross and originally selected on account of its superior malting quality. The seed of all the other varieties was obtained from the produce of the first pedigree plots grown at Ballinacurra Cereal Station in 1928.

The names of the plot-holders, the nature of the soil, the crops grown on the land during the two preceding years, and the dates of sowing and harvesting at each centre are shown in Table I. In Table II. are set out the yields per statute acre, the value per barrel of the grain produced and the value of grain, including screenings, per statute acre.

Spratt-Archer 37 No. 3 produced on the average a heavier yield of dressed grain and a better return per acre than either of the other two types of Spratt-Archer included in the trials. A.G.S. 3/3/3, which in the small scale trials had given promising returns, proved distinctly inferior in yielding

capacity to the other varieties, and as it possesses comparatively weak straw it is doubtful if it is worthy of further trial.

Old Irish again did well at the one County Wexford centre, where it was tried and demonstrated its suitability for that district. The malting quality of the grain was again inferior to that of the other varieties included in the experiment.

July Six-Rowed, which was harvested on July 30th, that is, fifteen days before the earliest of the Spratt-Archer types grown on the adjoining plots, again produced a lower yield than any of the other varieties. The value of the produce was considerably reduced, due to the unevenness of the sample.

TABLE I.

LARGE SCALE VARIETY EXPERIMENTS, 1929.

Centre	Name and Address of Grower.	Description of Soil.	Previous Crops.	Date of Sowing.	Date of Harvesting
1	Mrs. Tait, Hermitage, Rostellan, Co. Cork.	Loam ... Sub-soil Shale	Oats, '27 Mangolds, '28	April 7th	August 28th
2	Wm. Watkins, Coolnagrower, Birr, Offaly.	Light Loam ... Sub-soil Gravel	Oats, '27 Roots, '28	April 4th	Sept. 2nd-4th
3	A. E. Smyth, Raheen, Donaghmore, Leix.	Stiff Loam ... Sub-soil Limestone.	Barley '27 Roots, '28	March 15th	August 30-31st
4	W. J. Waller, Prior Park, Nenagh, Co. Tipperary.	Light Loam ... Sub-soil Gravel	Turnips, '27 Beet and '28 Mangolds.	April 8th and 9th.	Sept. 2nd-3rd
5	M. P. Minch, Rockfield, Athy, Co. Kildare.	Deep Loam ... Sub-soil Gravel	Oats, '27 Roots, '28	March 13th	July 30th August 14-20th
6	Mrs. Segrave, Dunany, Dunleer, Co. Louth.	Stiff Loam ... Sub-soil Clay	Oats, '27 Turnips, '28	March 23rd	Sept. 2nd-3rd
7	P. Byrne, Ballygrangans, Kilmore, Co. Wexford.	Sandy Loam ... Sub-soil Gravel	Oats, '27 Roots, '28	April 5th	August 22-23rd
8	N. Howlett, Ramsgrange, Co. Wexford.	Stiff Loam ... Sub-soil Shale	Oats, '27 Turnips, '28	April 3rd	Sept. 2nd-3rd
9	H. Burke, Kilmacoe Lodge, Curracloe, Wexford.	Sandy Loam ... Sub-soil Gravel	Barley, '27 Beet and '28 Mangolds.	April 13th	August 31st Sept. 2nd-3rd
10	D. Morris, Tomahurra, Enniscorthy.	Shale Loam ... Sub-soil Shale	Oats, '27 Roots, '28	March 26th	Sept. 3-4th

[TABLE II.

TABLE II.

LARGE SCALE BARLEY VARIETY EXPERIMENTS, 1929.

Yield and Value of Grain per Statute Acre.

Centre.	Spratt-Archer 37/6. Yield of Dressed Grain.	Spratt-Archer 37/6. Value per Barrel.	Spratt-Archer 37/6. Total Value,* including Screenings.	Spratt-Archer 37 No. 3. Yield of Dressed Grain.	Spratt-Archer 37 No. 3. Value per Barrel.	Spratt-Archer 37 No. 3. Total Value,* including Screenings.	Spratt-Archer 37 No. 4. Yield of Dressed Grain.	Spratt-Archer 37 No. 4. Value per Barrel.	Spratt-Archer 37 No. 4. Total Value,* including Screenings.	A.G.S. 3/3/3. Yield of Dressed Grain.	A.G.S. 3/3/3. Value per Barrel.	A.G.S. 3/3/3. Total Value,* including Screenings.	Old Irish. Yield of Dressed Grain.	Old Irish. Value per Barrel.	Old Irish. Total Value,* including Screenings.	July Six-rowed. Yield of Dressed Grain.	July Six-rowed. Value per Barrel.	July Six-rowed. Total Value,* including Screenings.
	brls. sts.	s. d.	£ s. d.	brls. sts.	s. d.	£ s. d.	brls. sts.	s. d.	£ s. d.	brls. sts.	s. d.	£ s. d.	brls. sts.	s. d.	£ s. d.	brls. sts.	s. d.	£ s. d.
CORK.																		
Mrs. Tait ..	10 12	15/–	8 5 11	12 2	15/3	9 9 7	12 1	15/–	9 6 3	10 6	15/–	8 2 3½	—	—	—	—	—	—
OFFALY.																		
Wm. Watkins ..	12 4	15/6	10 0 6½	14 2	15/6	11 4 3	12 11	15/9	10 8 6	12 10	15/9	10 10 2	—	—	—	—	—	—
LAOIGHIS.																		
A. Smyth ..	15 6	15/9	12 6 10	13 1	15/6	10 5 1½	11 6	15/9	9 1 2	11 14	16/–	9 12 8	—	—	—	—	—	—
TIPPERARY.																		
W. Waller ..	11 11	15/9	9 16 1	13 14	15/9	11 2 6½	13 2	15/9	10 12 0½	12 6	16/–	10 5 4	—	—	—	—	—	—
KILDARE.																		
M. P. Minch ..	11 8	16/3	9 12 10	11 6	16/–	9 8 0	12 9	16/3	10 8 10	10 14	16/3	9 4 0½	—	—	—	10 11	15/3	8 14 11½
LOUTH.																		
Mrs. Segrave ..	15 11	15/6	12 7 2	16 1	15/9	12 16 4	15 5	15/9	12 4 6	14 8	15/6	11 10 9	—	—	—	—	—	—
WEXFORD.																		
P. Byrne ..	16 2	15/9	12 15 11½	16 7	15/9	13 1 6½	15 7	15/9	12 5 9½	15 10	15/9	12 9 5	—	—	—	—	—	—
N. Howlett ..	11 4	15/9	9 8 6	11 1	15/9	8 18 11	12 1	16/–	10 4 4	9 2	16/–	7 12 0	—	—	—	—	—	—
H. Burke ..	9 13	15/9	7 19 10½	11 1	15/9	9 0 2½	10 14	15/9	8 17 11½	9 13	16/–	8 2 4	11 4	15/6	9 4 11½	—	—	—
D. Morris ..	11 5	16/–	9 2 4	12 13	16/–	10 6 4	13 14	16/–	11 3 4	11 12	16/–	9 9 4	—	—	—	—	—	—
Average (10 centres)	12 9	—	10 3 7	13 3	—	10 11 3	12 15	—	10 9 3	11 14	—	9 13 10	—	—	—	—	—	—

* Screenings valued at 8d. per stone.

4.—Small Scale Quantitative Experiment.

The standard variety used in this experiment was Spratt-Archer 37 No. 3. In addition seven new selections were tested. The plots were arranged in chessboard fashion in six squares abreast in sixteen consecutive lines. The order of sowing the varieties was changed about so as to get as even a distribution as possible of each variety over the entire area. Each variety was replicated twelve times.

Particulars of the varieties included in the experiment, the average yields obtained, and the percentage of nitrogen are shown in Table III.

TABLE III.

Small Scale Quantitative Experiments, Ballinacurra, 1929.

—	Total yield of Grain in grammes.	Nitrogen, per cent.
A.G. 4/5/1 X G.S. 18/1	2952·01	1·39
Spratt-Archer 37 No. 3	2908·86	1·47
A.G.S. 1/7/1/2	2856·74	1·47
G.S. 1/4 S.A. X 37/6 No. 2	2804·59	1·58
Donegal 2 row No. 1	2769·63	1·56
S.A. 37/18 X G.S. 18/1, 1/1/1	2574·12	1·49
Abed Rex X S.A. 37/18, 2/1	2421·16	1·58
G.S. 1/4 X S.A. 37/6, No. 1	1781·50	1·57

It is of interest to note that the higher yielding varieties were also of better malting quality, judged on the basis of low nitrogen content. In malting trials, however, all of the new varieties gave poor results compared with the standard variety Spratt-Archer 37 No. 3. A.G. 4/5/1 X G.S. 18/1, which gave the heaviest yield, proved superior in malting quality to the other new varieties.

5.—Half Drill Strip Experiments.

Three experiments were carried out on the farm of Mrs. O'Brien, Loughatalia, Ballinacurra. In each case Spratt-Archer 37 No. 3 was used as the standard, and the other varieties were as follows:—

No. 1 Experiment—Spratt-Archer 37/12/41.

No. 2 Experiment—Archer.

No. 3. Experiment—Spratt-Archer 37/6.

The yields obtained in each experiment are shown in Table IV. and particulars of the moisture content, nitrogen content, etc., of the grain produced by each variety are set out in Table V.

TABLE IV.

Half Drill Strip Experiment No. 1.

Strip.	S.A. 37/12/41 sts.	lbs.	ozs.	Strip.	S.A. 37 No. 3 sts.	lbs.	ozs.
a	2	9	12	B	2	11	0
C	2	12	4	b	2	12	12
c	3	0	12	D	3	1	0
E	2	12	0	d	3	0	8
e	3	3	0	F	3	4	0
G	2	1	8	f	2	10	8
g	3	1	0	H	2	12	0
I	2	13	4	h	2	12	8
i	3	1	0	J	3	1	0
K	3	2	0	j	3	1	0
k	3	3	0	L	3	0	12
M	2	13	8	l	3	2	4
m	2	13	4	N	3	0	0
P	3	0	8	n	3	1	8
p	3	0	0	Q	3	3	8
R	2	9	0	q	3	3	0
r	3	10	0	S	3	4	0
T	2	12	8	s	3	7	0
t	3	0	8	V	2	13	12
W	3	0	8	v	2	12	0
w	2	13	0	X	2	11	12
Y	2	13	0	x	2	13	8
Total...	65	5	4		66	13	4
Average	2	13	9		3	0	9

Half Drill Strip Experiment No. 2.

Strip.	Archer. sts.	lbs.	ozs.	Strip.	S.A. 37 No. 3 sts.	lbs.	ozs.
a	2	5	0	B	2	8	8
C	2	4	12	b	2	13	8
c	2	12	0	D	2	6	0
E	2	11	0	d	2	12	0
e	2	10	8	F	2	9	0
G	2	8	4	f	2	9	8
g	2	7	0	H	2	10	8
I	2	10	8	h	3	0	4
i	3	0	8	J	2	13	0
K	2	12	0	j	3	1	0
k	3	0	0	L	3	0	4
M	2	10	8	l	3	0	0
m	2	11	4	N	2	13	0
P	2	10	8	n	3	3	0
p	3	0	0	Q	3	2	4
R	2	12	8	q	3	0	4
r	2	11	8	S	2	12	0
T	2	11	8	s	2	13	0
t	2	11	0	V	2	13	0
W	2	13	4	v	2	11	8
w	2	11	8	X	2	8	0
Y	2	5	0	x	3	1	0
Total ...	60	8	0		63	6	8
Average	2	10	9		2	12	6

Half Drill Strip Experiment No. 3.

Strip.	S.A. 37/6 sts.	lbs.	ozs.	Strip.	S.A. 37 No. 3 sts.	lbs.	ozs.
a	2	6	8	B	2	6	8
C	2	6	0	b	2	7	8
c	2	8	12	D	2	7	12
E	2	6	12	d	2	9	4
e	2	9	8	F	2	9	8
G	2	6	12	f	2	12	12
g	2	9	12	H	2	9	8
I	2	6	0	h	2	10	12
i	2	6	12	J	2	4	0
K	2	5	12	j	2	8	8
k	2	6	0	L	2	7	8
M	2	3	12	l	2	8	8
m	2	6	0	N	2	5	0
P	2	5	4	n	2	4	4
p	2	7	0	Q	2	6	8
R	2	7	12	q	2	7	0
r	2	10	8	S	2	8	4
T	2	6	8	s	2	8	8
t	2	8	8	V	2	6	8
W	2	4	0	v	2	5	0
w	2	6	0	X	2	6	0
Y	2	1	8	x	2	5	8
Total ...	54	5	4		55	10	8
Average	2	6	9		2	7	7

TABLE V.

	Experiment No. 1.		Experiment No. 2.		Experiment No. 3.	
	S.A. 37/12/41.	S.A. 37 No. 3.	Archer.	S.A. 37 No. 3.	S.A. 37/6.	S.A. 37 No. 3.
Moisture, per cent. ...	20·3	20·1	20·8	20·7	19·9	19·5
Nitrogen, per cent. ...	1·57	1·50	1·73	1·58	1·62	1·51
Weight of 1,000 grains in grammes.	33·1	33·8	33·4	33·3	33·1	33·0
Average yield in lbs. after correction for wheel tracks and moisture.	40·8	41·2	37·5	39·0	34·2	35·1

Spratt-Archer 37/12/41, a selection which gave promising results in previous small scale trials, proved only very slightly inferior to Spratt-Archer 37 No. 3 in point of yield, but it was definitely inferior to the latter in malting quality.

The Archer variety included in experiment No. 2 was derived from a pure line propagation of the strain of this variety which was widely grown some years ago and which was, for a number of seasons prior to 1925, included as the standard variety in these trials. The main object in re-introducing the Archer variety was to ascertain how it compared with Spratt-Archer 37 No. 3, the variety which is now being distributed for seed purposes. In this trial Archer proved inferior to Spratt-Archer 37 No. 3, both as regards yield and malting quality of the produce.

The seed of Spratt-Archer 37/6 sown in experiment No. 3 was the produce of stock of this variety, which was superior in malting quality to ordinary stocks of the variety. Nevertheless, in this experiment it was found inferior in yield and malting quality to Spratt-Archer 37 No. 3, thus confirming the results obtained in previous trials.

In each of the three experiments Spratt-Archer 37 No. 3 produced the highest yield and both the moisture content and the nitrogen content of the produce was lower than that of any of the other varieties included in the experiments.

6.—The Influence of Nitrogenous Manures on the Quality of the Produce.

During the season of 1929 an effort was made to produce from a common stock, bulks of grain differing widely as regards nitrogen content. With this object in view three plots of approximately 1/5th of a statute acre each were sown on the farm of Mrs. O'Brien, Loughatalia, Ballinacurra. One plot was seeded at the normal rate of 12 stones per statute acre and the other

two plots at the rate of 7 stone per statute acre. One of these latter plots received two separate dressings of sulphate of ammonia at the rate of half-a-hundredweight per statute acre in each application. The dressings were applied at two periods, one at the time of sowing and the other when the corn brairded. No nitrogenous manure was applied to the other two plots.

As was expected the crop on the plot which received the Sulphate of Ammonia grew more vigorously than that on the unmanured plots and at harvest time appeared to be the heaviest crop. On analysis the nitrogen content of the produce of all three plots was found to be practically identical. As the results are contrary to those obtained in somewhat similar trials conducted previously it is proposed to repeat the experiment.

7.—Experiments in the Use of Copper Carbonate and Mercuric Chloride, Abavit Powder and Ge-Ka-Be as Preventives of Smut and Stripe Disease.

This experiment was again carried out at Ballinacurra, on somewhat the same lines as in previous years. The plots were arranged in four series of three plots each. The treatments were as follows:—

Plots Nos. 1, 4, 7 and 10.—Seed dusted with a mixture of Copper Carbonate and Mercuric Chloride.

Plots Nos. 2, 5, 8 and 11.—Seed dusted with Abavit powder at the rate of 200 grammes per cwt.

Plots Nos. 3, 6, 9 and 12.—Ge-Ka-Be treatment, *i.e.*, seed sprinkled with a concentrated solution of Germisan and revolved in a primus machine for five minutes.

The seed used was obtained from a stock in Co. Wexford and was very heavily contaminated with the spores of covered smut (Ustilago Hordei). The results were distinctly disappointing compared with those obtained in previous trials, the number of smutted plants found in all plots at harvest time being considerable. From the results shown in Table VI. it will be seen that the yields do not appear to have been affected by any of the treatments and that the plots treated with Abavit had much fewer smutted plants than those otherwise treated.

[Table VI.

TABLE VI.

TREATMENT FOR PREVENTION OF SMUT AND STRIPE DISEASE.

1929.

Plot Numbers. Series I.	II.	III.	IV.	Treatment.	Stripe Disease.	No. of Smutted Plants counted at Harvest Time. Series I.	II.	III.	IV.	Average.	Yield. Series I.	II.	III.	IV.	Average.
											sts. lb.	sts. lb.	sts. lb.	sts. lb.	sts. lbs.
1	4	7	10	Copper Catbonate and Mercuric Chrloride.	Very prevalent	368	237	253	335	298	9 2	9 4	8 12	9 3	9 $1\frac{3}{4}$
2	5	8	11	Abavit	Not prevalent	109	70	64	61	76	9 3	9 4	9 0	8 9	9 $0\frac{1}{2}$
3	6	9	12	Ge-Ka-Be	Prevalent ...	184	314	313	137	237	9 3	9 9	9 1	9 0	9 $3\frac{1}{4}$

Stripe disease (Helminthosporium) appeared first on the plots 1, 4, 7 and 10, that is, on those dusted with Copper Carbonate and Mercuric Chloride, and it was always most prevalent on these plots. The disease did not appear on the plots treated with Abavit until after May 21st, and was least prevalent on them throughout the season.

8.—Barley Cultivation in County Donegal.

(a) *Experiments.*

Some further experiments were carried out in the Northern parts of Co. Donegal in order to find out the most suitable types of barley for cultivation in those districts. The varieties tried were of the six-rowed type, with the exception of Old Irish, which was included, as it had given good results in the previous year. The seed of each variety was obtained from pure line stocks grown at Ballinacurra and was sown at the rate of 12 stones per statute acre. The area of the plots was in each case 1/3rd of a statute acre. The names of the growers, the nature of the soil, dates of sowing and harvesting, together with the yields of grain obtained at each centre, are set out in Table VII.

TABLE VII.

Grower.	Nature of Soil.	Variety.	Date of Sowing.	Date of Harvesting.	Yield of Grain per statute acre.
					stones.
Thomas Doherty, Cabry, Quigley's Point.	Sandy loam over clay.	July six-rowed ...	17/4/29	8/8/29	152
		Mansholt's six-rowed	17/4/29	24/8/29	172
		Donegal six-rowed ...	,,	17/8/29	152
		Old Irish	,,	27/8/29	180
B. O'Reilly, Cloonemore, Cashelmore.	Clay loam	Mansholt's six-rowed	23/4/29	2/9/29	88½
		Old Irish	,,	29/8/29	117

Old Irish again gave the heaviest yield at both centres and appears to be very suitable for cultivation in these areas, more particularly since the grain is not sold for malting. July six-rowed at the centre where it was grown ripened very much earlier than any of the other varieties, but the yield of grain was comparatively low. Mansholt's six-rowed barley gave a comparatively high yield at one centre, but at the other centre it gave a disappointing return. In respect of time of ripening it was as late as the Old Irish.

Donegal six-rowed, which is a pure line stock of the original native variety grown in the county, proved equal in yielding capacity to July six-

rowed but distinctly inferior to Old Irish and Mansholt's six-rowed. Although apparently a poor yielder this variety appears to be capable of producing reasonably good crops on poor soils in exposed positions.

(b) *Propagation of July Six-Rowed.*

In view of the results obtained in the experiments conducted during the previous season it was decided to further propagate July six-rowed barley in Co. Donegal during the season of 1929. With this object in view an extension plot of 2½ statute acres was grown on the farm of Miss McCormack, Dunross, Cooldaff. The soil was a dark peaty loam, which had been well cultivated and manured in previous years. The variety grew well, stood well, and produced an excellent crop. The produce was distributed in the following spring to growers in the district.

WHEAT.

(1) *Red Stettin.*

The Department again arranged for the growing of a large propagation plot of approximately 7 acres of Red Stettin 13 on the farm of Mr. Wm. Burke, Kilmore, Clonmel, Co. Tipperary.

The produce of the plot of this variety grown in the same district in the previous season was distributed for County Extension plots in the Counties of Cork, Kerry and Tipperary, as follows:—

	Stones
Jas. McKenna, Cloughjordan, Co. Tipperary	64
Rody O'Meara, Kilbiller, Borrisokane, Co. Tipperary ...	64
John Cronin, Granagh, Killarney, Co. Kerry	16
J. J. Doyle, Whitefield, Beaufort, Co. Kerry	16
Timothy Fitzgerald, Aulane, Abbeydorney, Co. Kerry ...	40
S. R. Lysaght, Hazelwood, Mallow, Co. Cork	40
D. O'Connor, Copestown, Mallow, Co. Cork	40
J. Tate, Hermitage, Rostellan, Co. Cork	50
Ml. Hyde, Toureen, Innishannon, Co. Cork	70
J. Lehane, Rockfarm, Carrigrohane, Co. Cork	88
J. Linehan, Ballincorrig, Whitechurch, Co. Cork ...	42
T. J. Burton, Minehall, Millstreet, Co. Cork	60
B. Bolster, Riverview, Banteer, Co. Cork	43½
Jeremy Kingston, Templebryan, Clonakilty, Co. Cork ...	16
M. J. Scully, Ardfield, Clonakilty, Co. Cork	16
J. O'Sullivan, Carrigroe, Clonakilty, Co. Cork	16
Total	681½

The produce of these plots, where suitable, was disposed of for seed in the Autumn of 1929. With the object of providing a further supply of pure seed of this variety, five barrels of pure line seed obtained from the Albert Agricultural College in the Autumn of 1929 were employed in seeding a

further large scale extension plot on the farm of Mr. W. Prendergast, Derrygrath, Cahir, Co. Tipperary.

(2) *Coney Island (Short Straw) and Coney Island (Long Straw).*

These two selections were grown both in Winter and Spring sown plots at the Department's stations at Athenry and Clonakilty. Unsatisfactory returns were obtained from both varieties in the Winter sown trials. In the Spring sown plots the Long Straw selection lodged and did not yield as well as the Short Straw selection. Further experiments with the latter are being conducted and with the object of providing supplies of seed a plot of about two acres was sown on the Department's farm at Athenry in the early Winter of 1929.

OATS.

Propagations.

(a) *Field Plots.*

In order to provide a stock of pure line Sandy Oats for disposal as a nucleus for further cultivation in those parts of Co. Donegal where this variety is extensively grown two field plots were grown at Ballinacurra Cereal Station. The seed for these plots was obtained from two garden plots grown in the previous season at the station. The original stocks of seed were obtained, one from Glasnevin Cereal Station and the other from Aberdeen.

The crops on both plots grew well and evenly and produced grain of good quality.

(b) *Extension Plots.*

Plots of Mansholt's III. and Potato III. were grown for observation and further propagation. The seed of both varieties was obtained from the Albert Agricultural College Cereal Station. Both varieties did well and produced good yields. Potato III. was, however, rather badly infected with Smut (Ustilago Avenae) and for this reason the seed had to be discarded.

(c) *Department's Large Extension Plots.*

In connection with the Department's Oat Propagation Scheme plots of Victory, Victory II. and Black Tartary were grown as follows:—

Victory .	12 acres on the farm of C. Fitzgerald, Heamount, Midleton, Co. Cork.
Victory II. .	11 acres on the farm of D. Mulcahy, Ballintubber, Carrigtwohill, Co. Cork.
Black Tartary	3 acres on the farm of J. H. Bennett, Ltd., Ballinacurra, Co. Cork.
	6 acres on the farm of T. Twomey, Ballintubber, Carrigtwohill, Co. Cork.
	3 acres on the farm of D Barry, Ballintubber, Co. Cork.

(d) *County Extension Plots.*

The seed of Victory, Victory II., Potato II. and Black Tartary distributed for County Extension plots in 1929 was produced in the previous year (1928) in the neighbourhood of Ballinacurra Cereal Station. The seed of Record and Glasnevin Sonas (formerly known as Banner Tartary 9) was obtained from the Albert Agricultural College, Glasnevin.

The names and addresses of the growers of County Extension plots in 1929, the variety sown, and the quantity of seed supplied in each case are set out in the following lists:—

Name and Address of Grower.	*Quantity of Seed supplied*
Black Tartary.	Sts.
J. J. Furlong, Littlegraigue, Co. Wexford	140
J. Magner, Kilquane, Castletownroche, Co. Cork	42
T. P. Holton, Enfield, Co. Kildare	28
G. N. Gossop, Barrisfram, Maryboro'	56
E. Doyle, Craans, Tullow, Co. Carlow	56
P. M. Dillon, St. Mullins, Co. Carlow	28
D. McGrath, Abbey Farm, Clonmel, Co. Tipperary ...	28
J. Reidy, Tarman, Kilrush, Co. Clare	21
P. Sexton, Mullagh, Kilmurray, Co. Cork	14
J. Keegan, Carrigtwohill, Co. Cork	42
B. Donovan, Kinsale, Co. Cork	28
D. Coughlan, Breeda House, Killeagh, Co. Cork	42
P. Kenny, Rath Lodge, Abbeyshrule	42
M. Mitten, Roundwood, Co. Wicklow	14
N. Horan, Greystones, Co. Wicklow	14
G. Hatton, Ashford, Co. Wicklow	14
J. Farrell, Ashford, Co. Wicklow	14
Miss O'Keeffe, Garryhesta, Ovens, Co. Cork	50
T. Gould, Castlemore, Crookstown, Co. Cork	32
J. Lehane, Crossmahon, Lissardra, Co. Cork	16
P. O'Donovan, Dunmanway, Co. Cork	16
J. Lordon, Dunmanway, Co. Cork	16
D. Caverley, Skibbereen, Co. Cork	16
P. Mansfield, Old Parish, Dungarvan, Co. Waterford ...	70
W. Whelan, Carrigeen, Co. Waterford	42
M. Cotter, Drisheen, Skibbereen, Co. Cork	8
Rowan & Co., Capel Street, Dublin	70
Total ...	959

Victory II.	Sts.
Rowan & Co., Capel Street, Dublin	70
J. Brennan, Gurteen, Templemore, Co. Tipperary	56
D. Ahern, Ballymagooley, Mallow, Co. Cork	56

Name and Address of Grower.	*Quantity of Seed supplied*
	Sts.
J. J. Donoghue, Kilbrin, Kanturk, Co. Cork	28
Mrs. Minogue, Scariff, Killaloe, Co. Clare	15
P. Deeling, Rathvilly, Co. Carlow	56
L. Kearns, Rathvilly, Co. Carlow	42
J. McS. McCullagh, Gerrardstown, Co. Dublin	42
The Rev. M. Ryan, Fethard-on-Sea, Co. Wexford	56
M. Long, Ardfinna, Cahir, Co. Tipperary	42
F. Prunty, Annybella, Castleblayney, Monaghan	28
H. McCabe, Crossmore, Monaghan	28
P. J. Cavanagh, Finod House, Co. Sligo	14
G. A. Cuffe, Owenbeg, Co. Sligo	14
J. Cahaney, Screen, Co. Sligo	28
M. Quinlivan, Gower Hall, Kilrush, Co Clare	56
A. Carolan, Tonyduff, Bailieboro', Co. Cavan	14
F. McCusker, Tonyduff, Bailieboro', Co. Cavan	14
P. Dolan, Owengalles, Bawnboy, Co. Cavan	14
M. Tewin, Cloverhill, Co. Cavan	14
D. Graham, Ballinagare, Kilbeggan, Westmeath	56
T. Kearns, Roxboro', Roscommon	42
Lt.-Col. Lefroy, Coneyglass Manor, Longford	42
M. Keenan, Ashtown, Co. Wicklow	14
A. T. Doyle, Lickeen, Co. Wicklow	14
P. O'Connell, Kilumney, Ovens, Co. Cork	14
E. Wall, Crookstown, Co. Cork	14
W. H. Frost, Glenbrook, Bandon, Co. Cork	14
C. Duggan, Greenfield, Ballincollig, Co. Cork	14
J. Boyle, Tonroe, Co. Mayo	28
W. Adamson, Ballina, Co. Mayo	28
W. Smiddy, Ballycotton, Co. Cork	28
D. Manning, Kilcoleman, Kinsale, Co. Cork	28
S. J. Feehan, Castlebellingham, Co. Louth	14
D. J. Rath, Clogherhead, Drogheda, Co. Louth	14
H. O'Reilly, Clonmore, Dunleer, Co. Louth	14
J. Fox, Mount Cashel, Roscommon	14
J. Kelly, Coolnahilly, Tullamore	56
N. Connors, Stradbally, Co. Waterford	42
R. Fitzgerald, The Abbey, Skibbereen, Co. Cork	16
J. Collins, Sams Cross, Clonakilty, Co. Cork	16
N. Balleen, Freshford, Co. Kilkenny	70
P. Shea, Fethard, Co. Wexford	56
P. J. Colgan, Rockingham Arms Hotel, Boyle, Co. Roscommon	14
D. Delany, Agricultural School, Ballyhaise, Co. Cavan ...	51
Total ...	1,528

Name and Address of Grower.	Quantity of Seed supplied
Victory.	Sts.
R. B. Reynolds, Beaufort, Co. Kerry	42
E. Langford, Milltown, Co. Kerry	28
J. Flynn, Skerries, Co. Dublin	28
P. Keogh, Newlands, Naas, Co. Kildare	28
A. Bradshaw, Drunkielney, Mohill, Co. Leitrim	28
J. MacManus, Beeghmore, Co. Leitrim	28
C. Foley, Aughamore, Dromod, Leitrim	14
M. Leonard, Farrihy, Charleville, Co. Cork	42
O. O'Sullivan, Broadford, Charleville, Co Cork	14
P. Scanlan, Appletown, Newcastle West, Co. Limerick ...	14
P. Gowing, Bochlone, Maryboro'	56
M. Cassin, Templemartin, Co. Kilkenny	56
B. Taylor, Ardrahan, Co. Galway	28
T. Cusack, Cloonloo, Co. Galway	28
Rev. Bro. Jarlath Edwards, Mount Bellew, Co. Galway ...	56
T. Hession, Ballydoty, Co. Galway	14
P. Lyons, Lixnaw, Co. Kerry	36
M. Dillon, Listowel, Co. Kerry	34
F. Holinan, Cong, Ballinrobe, Co. Mayo	14
T. Brown, Rockfield, Castlebar, Co. Mayo	14
R. Langan, Ballyglass, Balla, Co. Mayo	14
P. Ansbro, Mildbush, Castlebar, Co. Mayo	14
C. MacCarthy, Coolnagraune, Skibbereen, Co. Cork ...	16
L. M. Harris, Ballingaddy, Kilmallock, Co. Limerick ...	56
Total ...	702

Potato II.	Sts.
P. Gilhooley, Bonnybeg, Mohill, Co. Leitrim	28
P. Fox, Carrig, Co. Leitrim	20
J. McNally, Castleblayney, Co. Monaghan	28
J. McKenna, Castleblayney, Co. Monaghan	28
J Reilly, Stradone, Co. Cavan	7
J. Glynn, Lydican, Co. Galway	28
P. O'Connell, Carrarea, Roscommon	28
P. J. Colgan, Rockingham Arms Hotel, Boyle, Co. Roscommon	56
R. Moore, Churchtown, Carndonagh, Co. Donegal ...	56
T. Huey, The Grove, Lure, Co. Donegal	56
P. Borland, Rosnakill, Letterkenny, Co. Donegal	28
J. McGloin, Grefort, Ballina, Co. Mayo	16
J. Rafferty, Woodlawn, Co. Galway	28
W. Shannon, Cloonagh, Ballina, Co. Mayo	8
P. Rape, Tonybane, Corry, Ballina, Co. Mayo	8
Total ...	423

Name and Address of Grower.	*Quantity of Seed supplied*
Record.	Sts.
W. Prendergast, Derrygrath, Cahir	56
R. Gregan, Bennettstown, Dunboyne, Co. Meath	56
John Drohan, Scrahan, Kilmacthomas, Co. Waterford ...	56
P. Bartley, Santry, Co. Dublin	56
Total ...	224

Glasnevin Sonas.	Sts.
J. H. Bennett & Co., Ballinacurra, Co. Cork	112
Rev. Fr. Finucane, S.J., Clongowes Wood College	70
Prof. R. G. White, University College, Bangor	12
J. O'Donohoe, Kilbrin House, Kanturk, Co. Cork	28
P. O'Connor, Islandas, Boherbue, Banteer, Co. Cork ...	28
W. H. Bryan, Maryville, Enniskeen, Co. Cork	14
J. Canning, Waterpark, Fermoy, Co. Cork	42
Dr. Hatch, Rathclare, Buttevant, Co. Cork	28
J. O'Sullivan, Innishannon, Co. Cork	22
C. O'Sullivan, Dromkeen, Innishannon, Co. Cork	20
S. Levis, Cappa, Bandon, Co. Cork	20
D. McCarthy, Annaville, Bandon, Co. Cork	20
John Ryan, Acres, Dripsey, Co. Cork	20
A. Meligan, Kilfinnane, Glandore, Co. Cork	14
John Jordon, Lisheenleigh, Dunmanway, Co. Cork	14
John Kelly, Fennermore, Mullagh, Co. Clare	28
B. Crowley, Breaghoa, Kilrush, Co. Clare	14
W. Smith, Dromoland, Newmarket-on-Fergus, Co. Clare ...	80
M. Ryan, Coolteen, Barnstown, Co. Wexford	42
R. Walsh, Kilmurry, Cordal, Castleisland, Co. Kerry ...	28
J. McCarthy, Clydane, Castleisland, Co. Kerry	14
John Daly, Annagh, Castlemaine, Co. Kerry	14
D. Thornton, Clashmealcon, Causeway, Co. Kerry	56
P. J. Colgan, Agrl. Instructor, Boyle, Co. Roscommon ...	28
John Drury, Ardsallagh, Boyle, Co. Roscommon	14
M. J. Strain, Ballygalda, Roscommon	84
G. Massey, Carne, Killala, Co. Mayo	28
P. O'Neill, Danestown, Balrath, Navan, Co. Meath	56
John Mahon, Effernagh, Carrick-on-Shannon, Co. Leitrim ...	14
R. Gilhovey, Bonneybeg, Mohill, Co. Leitrim	14
A. Strahan, Moone, Ballytore, Athy, Co. Kildare	84
J. McS. McCullagh, Gerrardstown, Ballyboghil, Co. Dublin	70
P. Long, Coultry, Santry, Co. Dublin	42
J. Duff, Clonmel House, Ballymun, Co Dublin	42
M. Maher, Pappingtry, Finglas, Co. Dublin	56
W. Gorry, Cappyroe, Daingean, Offaly	70

Name and Address of Grower.			*Quantity of Seed supplied*
Glasnevin Sorts—continued.			Sts.
P. O'Brien, Grangebeg, Fethard, Co. Tipperary	...	...	42
E. Stokes, Kilmore, Clonmel, Co. Tipperary	...	...	28
W. Meagher, Laha, Templemore, Co. Tipperary	...	...	70
James Cribben, Cloughan, Mullingar, Co. Westmeath		...	14
F. W. Russell, Lissirode, Moate, Co. Westmeath	...	...	28
Col. O'Dell, Kilclogh Park, Moate, Co. Westmeath	...	...	28
H. Garrahan, Creevaghbeg, Ballymahon, Co. Longford		...	42
F. Geoffrey, Rathcline, Lanesboro', Co. Longford	...	...	42
M. Farrell, Lisnacusha, Lanesboro', Co. Longford	...	...	14
James Gavigan, Thurreen, Lanesboro', Co. Longford		...	14
L. Cullen, Rathmore, Ashford, Co. Wicklow	...	...	56
L. Lavan, Ballyknockeen, Glenealy, Co. Wicklow	...	...	14
M. Power, Ballyduff, Kilmeadon, Co. Waterford	...	...	84
Theo. Flynn, Coolnagower, Dungarvan, Co. Waterford		...	28
J. Harmon, Salsterstown, Dunleer, Co. Louth	...	...	28
P. McGuinness, Newrath, Castlebellingham, Co. Louth		...	14
S. Feehan, Bragganstown, Castlebellingham, Co. Louth		...	14
Major Barrow, Milestone House, Castlebellingham, Co. Louth			14
John McKeon, Seabank, Castlebellingham, Co. Louth		...	14
James McDonnell, Mullacloe, Ardee, Co. Louth	...	...	14
Mrs. R. Byrne, Little Arthurstown, Ardee, Co. Louth		...	14
Total		...	1,958

FLAX.

1. Propagations.

Single line and garden plots were grown at Ballinacurra Cereal Station as follows:—

(a) Single Plant Selections:—
  Department's Pure Lines Nos. 2, 3, 5, 6.
  Danish Pedigree Nos. 7, 21, 40.
  J. W. S. Pedigree.
  J. W. S. White Flowering No. 21.
  9 Selections of No. 6 x White Flowering.

(b) Garden Plots:—
  Department's Pure Line No. 6.
  Danish Pedigree No. 21.

With the exception of three of the pure lines, namely, No. 6 x White Flowering Selections 10/1, 10/2, and 10/3, all flax cultivations were affected with Browning disease (Polyspora lini). Many of the single plant selections were so badly affected with the disease that they failed to produce seed. The three exceptions mentioned appeared to be highly resistant to the disease and on this account may be valuable for further propagation.

2. Experiments.

(a) *Control of Browning Disease (Polyspora lini).*

In view of the prevalence of Browning disease on flax an experiment was conducted at Ballinacurra with the object of comparing the relative value for the control of the disease of various seed treatments. Particulars of the various treatments compared, the results obtained, etc., are shown in Table VIII.

TABLE VIII.

Variety of Seed sown—Department's Pure Line No. 2.

Area of each plot—1 sq. perch.

Seed sown per plot—10 ozs. (285 grams).

Date of sowing—6th May.

Plot.	Treatment.	Rate.	Method of application of treatment.	Percentage of infected plants.	Weight of Fibre harvested. sts.	lbs.
1	Abavit ...	5 : 1,000 (1·43 gr.)	Applied dry, shaking for five minutes.	4	4	9
2	$CuCO_3$—$HgCl_2$	5 : 1,000 (1·43 gr.)		9	4	9
3	Tillantin R. ...	5 : 1,000 (1·43 gr.)		36	3	2
4	U. T. 871 ...	5 : 1,000 (1·43 gr.)		2	4	11
5	U. T. 685 ...	20 : 1,000 (5·7 gr.)		3	4	12
6	$HgCl_2$, ...	0·1 : 100	Seed steeped for one hour in chemical dissolved in 60 per cent. spirit (63 per cent. Meth. Sp.	19	3	11
7	Germisan ...	0·25 : 100		16	3	6
8	Uspulun ...	0·25 : 100		39	2	7
9	None (Control)	—	—	61	1	12

The control or untreated plot (No. 9) was by far the most seriously diseased, over sixty per cent. of the plants being noticeably affected. Of the other plots those treated with Uspulun (Plot No. 8), Tillantin R. (Plot No. 3), Mercuric chloride (Plot No. 6) and Germisan (Plot No. 7) were most seriously affected in the order given, the Uspulun treated plot being the worst. The fact that the latter plot was next to the control may, however, have made some difference.

The plots treated with Copper Carbonate and Mercuric Chloride (Plot No. 2) and with Abavit (Plot No. 1) were much less seriously affected than the plots already mentioned. The percentages of visibly diseased plants being 9 and 4 respectively.

The plots treated with U.T 685 (Plot No. 5) and U.T. 871 (Plot No. 4) were outstanding throughout the season on account of their freedom from disease. The percentage of diseased plants recorded on these two plots were 3 and 2 respectively. Moreover, the infection when present was of a mild type. Further experiments are being conducted with the four treatments which gave the most satisfactory results in these trials.

6.—Variety v. Manurial Trials.

Trials were conducted at five centres in the flax-growing areas with the object of determining:—

(a) The relative values of five different varieties.

(b) The influence of a dressing of artificial manures consisting of ½ cwt. Sulphate of Ammonia and 1½ cwt. Muriate of Potash per statute acre.

(c) The effect of substituting nitro-chalk for Sulphate of Ammonia in the mixture of artificial manures applied to the crop.

Particulars as to the varieties sown, the manures applied and average results obtained are set out in Table IX.

TABLE IX.

Plot.	Variety.	Manures applied per Statute Acre.	Average Returns per Statute Acre			
			Yield of Scutched Flax.	Percentage of Scutched flax from retted Straw.	Value of Scutched flax per stone.*	Return from Scutched Flax.
			sts. lbs.		s. d.	£ s. d.
1	Dutch	½ cwt. Sul. of Ammonia. 1½ cwt. Muriate of Potash.	32 0	12·2	6 9½	11 17 4
2	Danish Pedigree No. 21.	do. ...	30 12	14·3	6 9½	10 9 7
3	"J.W.S" (English grown.)	do. ...	29 13	12·4	6 9	10 2 0
4	Riga ...	do. ...	26 4	11·4	6 8	8 15 3
5	Riga	74 lb. Nitro-chalk 1½ cwt. Muriate of Potash.	24 13	11·5	6 4	7 17 11
6	Riga ...	None	23 4	10·3	6 7	7 13 4

* The Flax grown on each plot at each centre was valued separately; these figures represent the average of the valuations.

Dutch flax, which in similar tests conducted in previous years proved inferior in yielding capacity to Danish Pedigree 21 and Riga flax, gave the best returns. Contrary to the results obtained in the previous season better yields and better quality fibre were obtained where sulphate of ammonia was used than where an equivalent quantity of nitro-chalk was applied.

PLANT BREEDING, 1928-29.

Report of the Plant Breeding Department of University College, Dublin, at the Albert Agricultural College, Glasnevin for the Season 1928-29.

By M. Caffrey, A.R.C.Sc.I., *Lecturer in Plant Breeding.*
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The work of the Plant Breeding Department during the season 1928-29 was mainly concerned with the production and propagation of improved types of oats, wheat, barley, grasses and clovers. Details of the experiments carried out, in the case of each of the crops referred to, are set out below :—

I. Oats.

(i) *Pure Line and Hybrid Cultivations.*—Pedigree cultivations of Victory, Victory 2, Glasnevin Sonas,* Victory-Mogul 12/2/1, Potato (3 selections), Banner-Tawny, Abundance-Tawny, Black Tartary and Black Tartary-Victory 2 were continued in nursery, garden and field plots on the College farm.

Hybrid forms derived from crossings between Glasnevin Sonas and Victory 2, Glasnevin Sonas and Marvellous, Mansholts III. and Victory-Mogul 12/2/1, Black Tartary and Black Mogul, were also propagated, and the most promising selections from each cross were retained for further cultivation.

In connection with the oat propagation scheme of the Department of Agriculture (1),** a large extension plot of over sixteen statute acres of Glasnevin Sonas was grown. Small extension plots of about a statute acre each of Victory, Victory 2, Victory-Mogul 12/2/1, Potato, Potato 2 and Black Tartary were also propagated on the College farm. The produce of the extension plot of Glasnevin Sonas was distributed in the spring of 1930, in collaboration with the Department of Agriculture direct to farmers for the sowing of *County Extension Plots.* The produce of the small extension plots was used for the sowing of *Department's Extension Plots* in 1930.

The extension plots of Glasnevin Sonas and Victory 2, were sown contiguously, under similar conditions as regards soil, seed rate and date of sowing, and arrangements were made to determine how these varieties compared in respect of establishment and tillering capacity. Accordingly, a rectangular strip of each variety running the entire length of the field, each having the same

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* Formerly known as Banner-Tartary 9.

** Reference by number in brackets is to "Literature Cited," p. 119.

width, was marked out in the second week of May. In each strip, the number of plants and the average number of tillers per plant were determined on thirty-four evenly spaced separate foot-lengths of the rows sown by the corn drill. The results of these determinations are set out in the following Table.

TABLE I.

Variety.	Average No. of plants per foot length.	Mean difference in favour of Glasnevin Sonas with Standard Error.	Average No. of tillers per plant.	Mean difference in favour of Glasnevin Sonas with Standard Error.
Glasnevin Sonas ...	15·8	2·3 + 1·093	3·16	·57 + ·19
Victory 2 ...	13·5	—	2·67	—

Glasnevin Sonas in this test had a significantly greater number of tillers per plant than had Victory 2.

As an illustration of the extent of the range of the variation which may be expected in determinations of this kind, it may be mentioned that, in the case of Glasnevin Sonas, the number of plants per foot-length varied from 5 to 28, while the total number of tillers per foot-length varied from 24 to 82.

(ii). *Quantitative Variety Experiments.*—The oat breeding investigations carried out up to the present on the College farm, have had one main object in view, viz. :—the production of prolific varieties possessing stronger straw than any hitherto available. These investigations have already resulted in the production of Glasnevin Sonas which, in the experiments conducted throughout Saorstát Eireann, has proved to be a very prolific and exceptionally strong-strawed variety (2). In addition many other very promising new oat varieties possessing strong straw have recently been obtained by selection and cross-fertilization, and it was decided to have the best of these tested with standard varieties in chess-board quantitative experiments during the season 1929. Two series of experiments were therefore undertaken, the first series being confined to white-grain varieties, and the second to black-grain varieties.

Series 1.

The varieties included comprised :—Victory 2, Victory No. 3, Victory-Mogul 12/2/1, Banner-Victory 2, Victory-Record 1/1, Victory-Record 3/2. Twelve plots of each variety were laid down, the plots being arranged on the usual chess-board principle so as to minimise yield differences due to soil variation. The plots were sown on the 15th and 16th March on a well prepared seed bed. The area of each plot was 16 square feet, but only 9 square feet of each plot was harvested, as the outside rows and six inches at the end of the remaining

six rows of each plot were discarded to minimise the effects of competition and shading from adjacent varieties.

When the plots were harvested the number of surviving plants and of ear-bearing tillers per plant were determined. Subsequently the weight of dressed grain and of straw per plot, the weight of 1,000 corns, and the percentage of kernel and of husk of each variety was ascertained. In the following Table (Table II.) the more important figures obtained are set out :—

TABLE II.

Variety.	Wt. of dressed grain per plot.	Difference in grams. from Victory 2.	Wt. of 1,000 corns.	Percentage of Kernel.
Victory-Record 3/2	417 grams.	+54	45·6 grams.	72·1
Victory-Record 1/1 ...	396 ,,	+33	44·5 ,,	71·7
Victory-Mogul 12/2/1	385 ,,	+22	42·6 ,,	74·3
Banner-Victory 2 ...	363 ,,	0	43·1 ,,	75·3
Victory 2	363 ,,	—	41·2 ,,	74·1
Victory No. 3 ...	360 ,,	—3	43·4 ,,	73·6

The Standard Error of the yield of dressed grain using the formula $\sigma_{\bar{d}}^2 = \frac{2m}{m-1}\left(\sigma_{\bar{v}}^2 - \sigma_{\bar{p}}^2\right)^*$ was found to be 13.69 grams. ; and as differences two and a-half times as great as this may be regarded as significant it is clear that, in this particular test, Victory-Record 3/2 is definitely superior in yield to Banner-Victory 2, Victory 2, and Victory No. 3. Victory-Record 1/1 is significantly superior to Victory No. 3. No significance whatever may be attributed to the differences separating Victory No. 3, Victory 2, Banner-Victory 2, and Victory-Mogul 12/2/1.

It will be noted that the two Victory-Record hybrids have a lower percentage of kernel, and, therefore, a higher percentage of husk than the remaining varieties. In this respect they—*i.e.* the Victory-Record hybrids—resemble Record.

Series 2.

In this series only two varieties were included, viz. :—Black Tartary and Black Tartary-Victory 2. The latter had already proved to be a most promising hybrid variety in the qualitative trials previously carried out, and, as it stands better and produces a blacker and plumper grain than Black Tartary it was only necessary to determine whether it compared favourably in yield with the latter variety before taking steps to propagate it as a field plot in 1930 with a view to having it tested in quantitative experiments on a large scale in 1931. Twenty-one plots of each variety were sown on the 4th and 5th March, the usual chess-board arrangement being adopted.

* Engledow and Yule :—The Principles and Practice of Yield Trials, p. 21.

During the early growing season the plots of Black Tartary-Victory 2 grew more rapidly and produced a sturdier and more leafy type of plant than those of Black Tartary.

In the following Table (Table III.) the average yield of dressed grain per plot, the weight of 1,000 corns, the percentage of kernel, and the mean difference in respect of dressed grain in favour of Black Tartary-Victory 2 are set out :—

TABLE III.

Variety.	Weight of Dressed Grain per plot Average of 21 plots.	Difference in favour of Black-Tartary-Victory 2.	Weight of 1,000 corns.	Percentage of Kernel.
Black Tartary-Victory 2	421 grams.	134 grams.	41·45 grams.	73·3
Black Tartary ...	287 ,,	—	39·6 ,,	72·9

The Standard Error of the mean yield, which was obtained from a comparison of 21 pairs of contiguous plots using the formula :—$SE=\sqrt{\frac{\Sigma d^2}{n(n-1)}}$ was found to be 6.8 grams. The odds are, therefore, very great that the yield difference recorded in favour of Black Tartary-Victory 2 in the above experiment is evidence of the superiority of that variety to Black Tartary in yielding capacity.

Experiment to compare the Yielding Capacity of Castleton Oats with Three Pedigree Strains of Potato Oats.

Castleton oats is the progeny of a mass-selected stock of Potato oats, and is now grown to a large extent in Scotland. A small scale experiment was arranged for on the College farm to determine how it would compare in yielding capacity with three Irish pedigree strains of Potato oats. In this experiment three series of plots were laid down, the order of sowing in each series being :—Potato, Potato 2, Potato 3, and Castleton. Each plot was eight square yards in extent. The seed for the sowing of the pedigree strains of Potato was obtained from the pedigree stocks grown on the College farm. while that for the sowing of the Castleton plots was obtained from a Scotch seed merchant. The plots were sown during the third week of March under very favourable conditions.

The plots were harvested in good condition during the last week of August. There was no difference in time of ripening between Potato, Potato 2, and Castleton. Potato 3 was distinctly later in this respect. When properly saved the total weight of produce per plot, the weight of dressed grain per

plot, the weight of 1,000 corns, and the percentage of husk of each variety was determined. The results are set out in the following Table.

TABLE IV.

Variety.	Average Weight of Produce per plot.	Average Weight of Dressed Grain per plot.	Weight of 1,000 Corns.	Percentage of Husk.
Potato 1	227·3 ozs.	75·7 ozs.	30·62 grams.	26·0
Potato 2	226·7 ,,	73·7 ,,	32·68 ,,	26·8
Potato 3	260·7 ,,	74·0 ,,	34·02 ,,	25·9
Castleton	196·7 ,,	57·0 ,,	32·12 ,,	25·2

It will be noted that Castleton was much inferior in yield of produce and in yield of dressed grain per plot to each of the three pedigree strains of Potato. In respect of weight of 1,000 corns and of percentage of kernel there was no significant difference between any of the varieties tested. In shape and colour of grain Castleton resembles Potato 1 closely.

(iii). *Winter Oats.*—Quantitative variety experiments with winter oats have been discontinued for the present on the College farm. Attention is concentrated for the time being on the production of new white grain types possessing the typical winter hardy habit of growth.

In an endeavour to secure varieties of this kind, a pedigree strain of a very hardy native variety, known as Wexford Tawny, has been crossed respectively with Victory, Abundance and Banner. None of the forms resulting from the Victory-Wexford Tawny cross have proved to be entirely satisfactory, and consequently they have all been discarded. From the other crossings referred to some very winter-hardy white-grained types have been obtained. and are now being propagated as field plots. It is hoped to test them in quantitative experimental plots against commercial winter-hardy varieties during the season 1930-31.

II. Wheat.

(i). *Pure Line and Hybrid Cultivations.*—Pedigree cultivations of Yeoman 2, Yeoman, Iron Master, Red Stettin 13, Yeoman-Iron, Yeoman-Red Stettin (2 selections), Yeoman-Queen Wilhelmina, April Red (3 selections) and Old Galway Red were continued in garden and field plots on the College farm. Cultivations of unselected commercial seed of two old native varieties—Grey Lammas, obtained from Co. Waterford, and Hen Gymro, a native Welsh wheat (very kindly supplied by Mr. T. J. Jenkin, B.Sc., of the Plant Breeding Institute, Aberystwyth, Wales), were grown in observation plots, and selections of individual plants from each stock were made at harvest.

Propagations of promising new types derived from crossings between Yeoman 2 and Red Stettin 13, Cooney Island and Red Stettin 13, Cambridge Browick and Old Galway Red, Cambridge Browick and Red Stettin 13. Yeoman-Iron and Red Stettin 13, April Red and Crown, and Iron Master and Yeoman-Stettin, were grown in nursery and garden plots. The best forms obtained from each of the above crossings were retained and are being propagated in observation plots during the present season.

Successful crossings between Yeoman 2 and Iron Master, Yeoman-Iron and Iron Master, April Red and Yeoman 2, April Red and Iron Master, April Red and Iron, April Red and Millennium were made in July, 1929.

It is hoped that prolific wheat varieties, which can be sown safely even in late spring will be obtained from the progeny of those crossings in which a pedigree strain of April Red was used as one of the parents. The need for such varieties is painfully evident in districts where the winter rainfall is above the average, and where, consequently, it is frequently impossible to sow winter wheat at the proper time.

(ii) *Quantitative Variety Experiments*.—Owing to the unfavourable weather conditions which obtained in the late autumn of 1928, it was only possible to carry out one large scale winter wheat variety experiment during the season under review. Four varieties were included in this experiment, viz. :—Yeoman 2, Yeoman, Iron Master, and Yeoman-Queen Wilhelmina. The seed for these experimental plots was supplied from pedigree stocks grown during the previous year on the College farm.

The plots were sown on the 24th October, 1928, on a well prepared seed-bed on land which during the preceding season had carried a potato crop. The braírds were satisfactory and little, if any, loss occurred through winter-killing.

During the early part of May, 1929, an examination of the plots was made to determine the average number of surviving plants per unit area and of tillers per plant in respect of each variety. This examination showed that at that period there was little difference between the varieties as regards establishment. As regards tillers per plant, Yeoman 2, which in the trials carried out on the farm has always proved to be a good tillering variety, gave the best result; but owing to the large fluctuations which occurred in the actual tillering capacity of the individual plants examined, the differences between the varieties were not statistically significant in any case.

In respect of strength of straw there was no apparent difference between the plots of Yeoman 2, Yeoman, and Iron Master, all of which were standing perfectly at harvest. Yeoman-Queen Wilhelmina became partly lodged previous to cutting, and it was evident that on heavy soils in unfavourable seasons this latter variety could not be relied upon to stand erect until ripe.

Yellow rust (Puccinia Glumarum) occurred on all the experimental plots during the month of April. Yeoman-Queen Wilhelmina was most severely attacked. Further attacks of this fungoid disease recurred at frequent intervals until the plots were ripe, but fortunately the disease did relatively little damage to the developing grain.

The plots were all harvested and saved in good condition. Determinations of the total weight of crop in tons and hundredweights, and of the weight of dressed grain of each plot in barrels and stones and in hundredweights and stones, per statute acre, were carried out. In the following table (Table V.) the results obtained are set out, the figures in each case being the average weight of three experimental plots :—

TABLE V.

Variety.	Total weight of Crop (Grain and Straw).		Weight of Dressed Grain.			
	Tons.	Cwts.	Brls.	Sts.	Cwts.	Sts.
Yeoman 2	6	10	13	15	34	3
Iron Master	5	13	14	10	36	2
Yeoman	5	10	12	17	32	1
Yeoman-Queen Wilhelmina ...	5	5	13	9	33	5

Owing to the small number of experimental plots no statistical analysis of the results has been attempted.

It is interesting to note that as regards Yeoman 2 and Iron Master, this year's results confirm those obtained during the previous season on the Albert College farm. In both years Yeoman 2 gave the higher total weight whereas Iron Master gave the higher weight of dressed grain. The greater tillering capacity of Yeoman 2, under the conditions in which the experiment was carried out, very probably accounts for the former result. Iron Master (which was bred by the Plant Breeding Department) produces, however, a greater number of grains per ear than does Yeoman 2. Moreover the average weight of the individual grains of the former is greater than that of the latter. This is brought out in the following Table (Table VI.), in which the average weight of five separate lots of 1,000 corns each of each of the varieties included in the experiment is set out :—

TABLE VI.

Variety.	Weight of 1,000 corns (average of 5 separate determinations) with Standard Deviation.	
Iron Master	56·00	±1·87
Yeoman-Queen Wilhelmina	52·84	±1·07
Yeoman	49·64	±2·192
Yeoman 2	48·88	± ·960

When the standard deviations of the mean differences separating each of the above varieties from each of the other varieties were determined it was ascertained that Iron Master in this experiment proved significantly superior as regards weight of 1,000 corns to each of the remaining varieties. Yeoman-Queen Wilhelmina is significantly superior to Yeoman and Yeoman 2. There is, however, no significant difference in this respect between Yeoman and Yeoman 2.

(iii) *Natural Crossing in Wheat.*—During the period in which investigations on wheat on a large scale have been carried out on the College farm it has been observed that many new types have appeared in pedigree cultivations which, considering the care taken in sowing, harvesting and threshing the individual plots, could not be accounted for, except on the theory that such plants have resulted from natural cross-fertilization between different varieties. The literature on the subject discloses the fact that a difference of opinion exists on the question of the frequency of natural crossing in wheat. Biffen and Engledow (3) state that the ears of F_1 plants are no longer protected at the Cambridge Plant Breeding Institute as "under English conditions out-pollination occurs so rarely that the likelihood of its interfering with the results is negligible." On the other hand Jenkin (4) found that a certain amount of natural crossing took place in certain strains of the old native variety Hen Gymro. Experiments carried out by Leighty and Taylor (5) in the U.S.A. led to the conclusion that natural crossing in wheat generally occurs, that the amount of natural crossing varies with different varieties, and that such natural crossings are more common in certain seasons than in others.

During the season 1926-27 a plot of Iron Master, a smooth glumed variety, was grown alongside a plot of Red Stettin 13, which produces "felted" glumes. When the seed progeny of the Iron Master plot was propagated in 1927-28 it was found on an examination of the resulting plants at harvest that 3 per cent. had "felted" glumes. The produce of representative plants of the aberrant types were separately propagated in 1928-29 in order to determine whether the progeny would split up into "felted" and smooth forms, as was to be expected if such plants were due to natural crossing. At harvest, when the progenies of the "felted" plants found in Iron Master were examined, it was ascertained that in every case they had split up into "felted" and smooth types, thus clearly demonstrating that natural crossing had taken place in the variety Iron Master in 1927.

The above experiment would tend to support the conclusions of Leighty and Taylor (loc. cit.). In this connection it is not without interest to state that Iron Master is the progeny of a natural crossing which took place between Iron and Square Head Master wheats in the cereal nursery in 1920.

III. Barley.

So far as barley is concerned the attention of the Plant Breeding Department will be concentrated on the production of varieties possessing very strong straw, so that the propagation of this cereal may be made possible on rich

soil such as that on the College farm. Having regard to the suitability of barley as a food for live-stock, especially pigs, this cereal would in all probability be more widely grown if strong strawed varieties were available. It is not proposed, however, to put on the market any variety, however suitable in other respects, which is not capable of producing a good malting sample when sown on typical barley soils.

The work undertaken is only in its preliminary stages, and at present attention is being paid to the collection of the strongest-strawed varieties grown in Europe and North America, and to observing how these varieties behave when grown on well manured land on the College farm. During the season under review, observation plots of Ottawa Duckbill, Svalöf Victory, Glabron, Svansota, Minsturdi and Trebi were compared with various strains of Spratt-Archer and with selections of native Donegal and Wexford barleys.

Ottawa Duckbill and Svalöf Victory proved to have strong straw and selections of the former are being further propagated. Svalof Victory barley is not, however, a satisfactory malting barley, and will not, therefore, be continued. It has, however, been crossed with Spratt-Archer 37 No. 4 and it is hoped that new forms derived from this crossing may be obtained combining earliness, high yield, quality of grain and strength of straw.

The American varieties, viz., Trebi, Minsturdi and Glabron, were satisfactory in many respects, but the quality of the grain for malting purposes was very poor. It will, therefore, only be possible to use these varieties for crossing with the commercial malting varieties grown in this country.

IV. Grasses and Clovers.

(1) *Quantitative Experimental Plots.*—On the setting up of the Plant Breeding Department in 1927, it was decided that the improvement of certain species of herbage plants should be proceeded with without delay. Accordingly, as a preliminary, representative samples of the various nationalities and strains of perennial rye grass, cocksfoot, red clover and white clover, in commerce were obtained, and small scale experimental plots were laid down in the spring of 1928. The object of these experiments, which will be continued for some years, is to ascertain how the various types of each of the plant species dealt with compare with each other as regards plant establishment, persistence, yield and resistance to disease. Incidentally it is expected that information will also be afforded as to valuable sources of parental material in subsequent breeding work.

The plots in each case were sixty feet in area—12 feet long by 5 feet wide. The seed was sown in drills one foot apart at the rate of 50 viable seeds per foot. Each plot was replicated four times, but owing to the failure of the plots on one section of the experimental grounds, results were obtained from only three plots in each case.

In each of the four species under review, yields of air-dry green produce were obtained in the autumn of 1928 (Seedling Cut) and in June, 1929 (1st Hay Cut). A further cut of the Red Clover plots was obtained in September,

1929 (Aftermath Cut). When harvesting the plots, the two outside rows of each plot, and two feet at the end were disregarded, thus the weight of the produce of only twenty-four square feet of each plot was determined.

The results of these experiments were as follows :—

TABLE VII.—PERENNIAL RYE GRASS.

Nationality or Strain.	Average yield per plot in ozs.		Total.	Taking Danish as 100.
	1928 Seedling Cut.	1929 1st Hay Cut.		
Danish	91·2	84·5	175·7	100
Scotch	89·6	86·5	175·1	99·7
Irish	89·6	82·0	171·6	97·7
Sutton's Wild	68·8	78·0	146·8	83·6
Garton's True Evergreen	87·2	53·0	140·2	79·6
Svalöf Victoria	66·0	70·0	136·0	77·4

Observations on the plots made in the late Autumn of 1929 showed that Sutton's Wild produced a very dense stand, and was likely to persist longer than any of the other types. Garton's True Evergreen has already died out to a considerable extent.

TABLE VIII.—COCKSFOOT.

Nationality or Strain.	Average yield per plot in ozs.		Total.	Taking Garton's Mowing as 100
	1928 Seedling Cut.	1929 1st Hay Cut.		
Garton's Mowing ...	64·0	129·5	193·5	100
Danish	62·6	128·3	190·9	98·7
Sutton's Indigenous ...	59·6	124·0	183·6	94·9
Garton's Grazing ...	63·2	104·0	167·2	86·4
New Zealand	52·6	102·7	155·3	80·3
American	43·8	103·7	147·5	76·2
Svalöf Scandia ...	45·0	100·7	145·7	75·3
French	37·6	96·7	134·3	69·4

In this experiment Garton's Mowing, Danish and Sutton's Indigenous gave good results in both seedling and first hay cuts. The two former, with American and French, were considerably earlier in time of earing than the others.

TABLE IX.—White Clover.

Nationality or Strain.	Average yield per plot in ozs. 1928 Seedling Cut.	1929 1st Hay Cut.	Total.	Taking New Zealand as 100.
New Zealand	105·6	161·5	267·1	100
Dutch	103·2	110·0	214·2	80·0
Wild White (Kentish) ...	79·2	124·5	203·7	76·3

It will be noted that as early as the first hay cut New Zealand and Wild White were superior to Dutch. The Plots when examined in autumn, 1929, showed that Dutch had practically all died out. Kentish Wild White had spread to a considerable extent. New Zealand was also spreading well but was obviously inferior in this respect to Wild White.

TABLE X.—Red Clover.

Nationality or Strain.	Type.	Average yield per plot in ozs. 1928 Seedling Cut.	1929 1st Hay Cut.	1929 Aftermath Cut.	Total.	Taking Suffolk as 100.
Suffolk	Late	185·6	262·0	145·0	592·6	100
Garton's New Perennialized ...	,,	197·6	246·0	137·0	580·6	98·0
Montgomeryshire ...	,,	197·2	244·0	127·5	568·7	96·0
Svalöf Swedish ...	,,	168·0	266·5	101·0	555·5	93·7
Cotswold	,,	145·6	250·7	128·0	524·3	88·4
Essex	,,	146·4	247·7	120·0	514·1	86·7
Cornish Marl ...	,,	146·4	221·0	107·0	474·4	80·1
Sutton's New Zealand Seeded	Early	157·4	199·3	98·5	455·2	76·8
Swedish	Late	130·0	225·3	88·0	443·9	74·9
English Broad Red ...	Early	143·2	200·0	97·0	440·2	74·3
Vale of Clwyd ...	,,	134·0	207·5	71·0	412·5	69·6
Dorset Marl ...	,,	122·2	198·5	81·0	401·7	67·8
American Mammoth ...	,,	95·4	179·7	60·5	335·6	56·6
Italian	,,	129·6	134·7	46·0	310·3	52·4
French	,,	106·8	142·0	60·0	308·8	52·1
Chilian	,,	115·0	135·0	48·5	298·5	50·4

In this experiment the late-flowering red clovers have proved to be more prolific than the early-flowering ones. A notable feature is the superiority in yielding capacity of the early English clovers over those obtained from America, France and Italy. Similar results have been frequently obtained in trials with clovers conducted in Great Britain. (See Williams (9)).

Although the experiments referred to above are subject to all the limitations contingent on small scale tests with field plots, it is evident that the results are of sufficient importance to justify further experiments in this country on

a larger scale, under conditions more closely approximating to ordinary field practice. It seems probable that such experiments might lead to the conclusion that the use in seed mixtures of some of the new strains of the herbage crops referred to would be desirable.

(ii) *Selection and Cross-fertilization Experiments.*—The experimental work in this connection is for the present being confined to the improvement of perennial rye grass and cocksfoot.

(a) *Mass Selection.*—In experimental work dealing with the improvement of grasses it is essential that the habits of growth of the individual plants dealt with should be known. Experience has shown that there is a great variation in this respect among the constituent strains of each grass species, and that as respects tillering capacity there are, broadly, two distinct types of plants, viz. :—those which tiller abundantly, and those which in comparison would be regarded as poor tillerers. The best types of the former are valuable for grazing purposes because they produce a leafy succulent herbage, with comparatively few seed bearing stems. The poor tillering types, on the other hand, produce a large proportion of seed producing stems and are, therefore, better suited for hay production than for grazing.

Stapledon (6) and Gregor and Sansome (7) have shown that ordinary commercial seed of cocksfoot and perennial rye grass gives rise to plants most of which are of the seed producing type. The same workers have also shown that plants obtained from old pasture lands, and from waste place habitats are superior to those grown from commercial seed in tillering capacity and forage production. The experimental work carried out by the Plant Breeding Department, University College, Dublin, so far as it has gone, confirms these conclusions. It is clear, therefore, that the most likely source for the supply of superior grazing strains of grasses suited for cultivation in Saorstat Eireann is to be found in the century-old pasture lands of the country, particularly those situated in County Meath and County Limerick. Good hay types may also be obtained from the same sources, but it is likely that the best strains of this type will be obtained by selection from the progeny of commercial seed.

The tillering capacity of a particular plant, which is a definite heritable character, is influenced to a marked extent by the environmental conditions under which the plant is grown. It can only be properly determined when the plant is propagated under the most favourable conditions as regards food supply, water, light and non-interference of neighbouring plants. The age of the plant also influences tillering. For these reasons the relative tillering capacity of individual plants cannot be accurately

gauged under the crowded conditions obtaining in a pasture or a hay field, and therefore selection of plants from the field, although quite feasible, is not the best method in grass improvement.

The procedure adopted by the Plant Breeding Department in connection with the production of superior pasture and hay types of cocksfoot and perennial rye grass has been as follows :—In the summer of 1928 collections of seed were made from certain well-known pasture lands in Counties Dublin, Meath and Limerick, and from waste place habitats in Co. Dublin. In all twenty-three lots of indigenous cocksfoot and twenty-two lots of indigenous perennial rye grass were obtained. These lots were sown separately in drills in September, 1928, with control drills of commercial Danish cocksfoot and commercial Irish perennial rye grass. In the spring of 1929 the resulting plants were transferred to the open field and were planted separately in rows two feet apart, the distance between contiguous plants in each row being two feet. In all about five thousand plants each of cocksfoot and perennial rye grass were transplanted. Satisfactory growth has since been made, and it is anticipated that by the early summer of 1930 it will be possible to select the best pasture and hay types respectively and to grow each in a limited mass selection plot.

(b) *Pure Line Selection.*—Plants of perennial rye grass and cocksfoot are normally cross-fertilized, though selfed seed can, in most cases, usually be obtained by using a suitable system of pollen proof isolation. The production of pure lines in these species would consequently introduce at the outset the difficulty of keeping plants isolated, so as to prevent the access of extraneous pollen. In addition to this it has been observed by Jenkin (8) and Stapledon (6) that the selfed progeny of perennial rye grass and cocksfoot plants almost invariably shows pronounced reduction in vigour. This phenomenon operates to a lesser extent in cocksfoot than in perennial rye grass, but even in the former it is of great importance. These facts have led Jenkin (8) to the conclusion that pure lines in the case of perennial rye grass cannot be used to the extent that would at first sight seem desirable.

Owing, however, to the numerous theoretical advantages which pure line selection possesses as a method of plant improvement it was felt desirable to obtain pure lines of both of the grasses referred to. During the flowering season of 1929 a number of plants of these species were selfed, using pollen proof cages. At the same time a certain number of inflorescences of the same plants were allowed to flower under ordinary conditions. Thus at harvest, selfed seed and ordinary cross-fertilized seed were obtained from a number of plants each of cocksfoot and perennial rye grass. These seeds were sown in boxes in a green-house during the late

autumn of 1929 and will be transplanted in the spring of 1930 where they will undergo tests to ascertain whether any loss of vigour is apparent in the selfed progeny.

(c) *Hybridization.*—Very little experimental work in this connection has yet been attempted. In the crossings that have been made the method of diallel crossing suggested by Jenkin (8) has been followed. Under this method a number of apparently suitable plants are chosen and are artificially hand crossed, each plant being crossed respectively with each of the other selected plants. The progeny of the different crosses is grown under similar conditions and a comparison of the progenies makes it possible to say which cross was the most suitable. The parents of the best crossings as indicated by the growth of their first generation progenies form the starting point of a new strain. This method renders it possible to eliminate poor parent plants. In the light of present knowledge it may be regarded as a sound method of approach to a very difficult problem. Its chief limitation is the large demand it makes on the time and facilities of the investigator.

In the early summer of 1929 four perennial plants of the hay-producing type were selected and were handcrossed each with the other in the greenhouse. The results are set out in Table XI.

TABLE XI.

Cross No.	Parent Plants.	No. of Florets Emasculated.	No. of Seeds Set.
1	A x D	112	35
2	B x D	114	67
3	C x D	98	52
4	A x C	104	31
5	B x C	114	35
6	D x C	72	31
7	D x B	108	42
8	D x B	112	46
9	B x A	108	64
10	D x A	143	21
	B x not pollinated.	82	0 (Control).

The seeds obtained from the above crosses will be grown during the coming season in the experimental grounds on the College farm.

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CONTROL OF RED MITE ON APPLE BY WINTER SPRAYING.

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(This article has already appeared in pamphlet form, having been received for publication in June, 1930.)

A previous paper by the senior author* dealt with preliminary tests with winter sprays for the control of Red Mite (*Oligonychus ulmi*). These tests demonstrated the inefficiency of the tar-distillate sprays in controlling the red mite, and also indicated that the oil sprays possessed marked ovicidal properties. In that paper the writer described a technique for counting, with a great degree of accuracy, the number of red mite eggs on twigs, and also a method for counting the number of mites which hatched out on sprayed twigs kept in jars of culture solution in the laboratory.

During the present season the writers carried out a comprehensive series of experiments with dormant sprays under both laboratory and orchard conditions. Twenty apple trees heavily invested with red mite eggs were selected for experiment. On each of the twenty trees there was, in addition to an abundance of red mite eggs, a fair infestation of aphis and sucker eggs. These trees were not sprayed with tar-distillate, as were the remaining trees in the orchard. Each spray was tested by applying it to two trees. There were accordingly eight lots of two trees; and the remaining four trees were allowed to remain as controls. Altogether six different sprays were tested in the orchard, namely: "Sunoco," "Volck," Lubricating Oil Emulsion, "Redolem," "Sunoco" combined with tar-distillate ("Carbokrimp"), and Lubricating Oil Emulsion combined with tar-distillate. The eight lots included in the test were accounted for by "Sunoco" and "Volck" being tried at two different times.

It has been considered advisable to give some particulars of each of the sprays used before proceeding to discuss the experiments in detail.

"*Sunoco.*"—This is a proprietary mineral oil spray in common use in the United States, but hitherto not in use in this country. For practical purposes it may be classed as one of the miscible oils, although the makers of the spray (Sun Oil Co., Philadelphia), say that it is not a miscible oil, but a "petroleum soap"—"a direct product of distillation, containing no animal or vegetable oils or soaps." They further state that it is not a lubricating oil composition, but "a product of distillation from special Californian asphalt base crude, the finished product containing 28 to 30 per cent. of petroleum 'fatty acids,' commonly known as naphthenic acids." "Sunoco" has the appearance and

* Journal, Dept. of Agriculture. Irish Free State. Vol. XXIX, No. 1.

consistency of heavy lubricating oil. It emulsifies very readily with water, soft or hard, and makes a very nice spray. It can be easily seen on the trees, is an excellent spreader, and has great cleansing properties. It can be used at 4 per cent. strength up to the time the buds are bursting, without causing any damage to the developing foliage.

"*Volck.*"—This is also a proprietary oil spray of United States origin. It is already in general use in this country, and is sufficiently well known as to render it unnecessary to describe it. "Volck" is a more expensive spray than "Sunoco," and for that and other reasons is not a good dormant spray for fruit trees. It wets the tree without colouring it, and does not spread very well on the bark.

Lubricating Oil Emulsion.—Such an emulsion may be made by using any type of lubricating oil and employing soft soap as the emulsifying agent. The particular emulsion used in the present experiments was made from a well-known high-grade oil, namely, Castrol XL. Doubtless a much cheaper oil might give somewhat similar results. The emulsion was made by using 1 lb. of soft soap, 1 gallon of lubricating oil, and ½ gallon of soft water. The oil, water and soap were heated together in an iron pot until the contents came to the boil. At this point the heat was cut off and the entire mixture was churned into itself a number of times by forcing it through an ordinary garden syringe. The resulting emulsion was then allowed to cool and, before being used for making up a spray, was strained through muslin in order to remove any scum that might have formed. Such an emulsion can only be diluted with soft water, as hard water would break the emulsion.

"*Redolem*" (Red Oil Emulsion).—As the name indicates, this is an oil spray in an emulsified form, and is readily miscible with water. It is made by a London Company of spray manufacturers, and is already known in this country.

"*Sunoco*" *combined with tar-distillate.*—This combination spray was tested in order to ascertain whether the properties of the oil and tar-distillate sprays would combine so as to give a spray which would kill the eggs of aphis, apple sucker and red mite. "Sunoco" and tar-distillate will not mix in their undiluted forms, but if each is made up as a separate spray, the two sprays may then be mixed without any apparent undesirable results. The resulting mixture makes an excellent wash, superior in actual physical properties to tar-distillate spray alone. It has particularly good cleansing properties, and is a spray that should readily appeal to the orchard owner.

Lubricating Oil Emulsion combined with tar-distillate.—What has been said of the "Sunoco" and tar-distillate combination, would apply equally well to this combination spray. In this case, however, soft water must be used to dilute the lubricating oil emulsion before mixing it with the tar-distillate.

The spraying experiment in the orchard was laid out according to the plan illustrated in the following table. "Sunoco" and "Volck" were tried in March as well as in January, as it is claimed that the oil sprays are more efficient when applied as delayed dormant washes.

ORCHARD EXPERIMENT.

TABLE showing date of spraying, spray used, number of trees sprayed, and strength of spray applied.

Date of Spraying.	Spray used.	Number of trees sprayed.	Percentage strength of spray.
January 21st ...	Sunoco	2	4
,, ,, ...	Volck	2	3
,, ,, ...	Sunoco and Carbokrimp combination.	2	3 of Sunoco (in total), 6 of Carbokrimp (in total).
,, ,, ...	Lubricating Oil Emulsion and Carbokrimp combination.	2	4½ Lubricating Oil Emulsion* (in total) 6 of Carbokrimp (in total).
February 13th	Lubricating Oil Emulsion	2	4½*
,, ,, ...	Redolem	2	4
March 26th ...	Sunoco	2	4
,, ,, ...	Volck	2	3
	Controls	4	—

Slight rain fell about 8 hours after the January sprays had been applied. Both the February and March sprayings were followed by about two days of dry weather.

In order to test the sprays more critically, than could be done in the orchard, a series of laboratory trials were also carried out by spraying cut twigs on which the number of red mite eggs had been counted. At the time of each orchard spraying a number of suitable twigs, infested with red mite eggs, were cut and brought into the laboratory. The number of red mite eggs on each twig was then counted by the method described in the senior author's previous paper, and the twigs were afterwards set up in jars of culture solution in the manner previously described. The twigs were sprayed with the different sprays under test, each spray being tried at different strengths, whereas only one strength was used for the orchard trials. During the period between the spraying and the hatching of the mites the twigs were kept in an unheated building where the conditions approximated closely to out-of-door conditions. During this period also the culture solution in the jars was changed at frequent intervals, and the twigs themselves were sprayed occasionally with water.

* 4½ per cent. of lubricating oil emulsion represents 3 per cent. actual oil content, as the emulsion contains ⅔ of its volume of oil.

Mites were first noticed on the twigs about April 20th, and as hatching proceeded they either migrated on to the leaves of the twig or else crawled off the twig and were trapped in the ring of vaseline surrounding its base. The task of counting the mites was begun about the middle of May. The mites on the leaves of the twigs and on the vaseline ring were counted in the same manner as last season, but this year, as an additional check, the number of red mite eggs remaining unhatched on each twig was also counted. This was done by cutting up the twig into small pieces (after the leaves and bud scales had been removed) and then counting the eggs directly under a binocular microscope. Any mites present on the stem of the twig were also counted at the same time, and the number thus recorded was added to the number present on the leaves and vaseline ring. Although counts were done on up to sixty twigs, it was found that in no case did the total number of mites plus the number of unhatched eggs amount to the number of viable eggs present on the twig at the first count. In the majority of cases the number of mites plus unhatched eggs was about 88 to 90 per cent. of the original number of eggs. In some cases this figure fell to about 85 per cent.

The original number of red mite eggs on each twig varied from about 200 to 1,600. There were in addition quite a number of aphis and sucker eggs on the majority of the twigs. These eggs were not counted, but observations were made as regards the relative number of aphis and sucker which hatched out on each twig.

The efficiency of each spray in killing the red mite eggs could not be written down as an exact figure, but had to be calculated from the available data. In each case, as already stated, the number of mites plus unhatched eggs, fell short of the original number of eggs. It would not by any means be correct to assume that the deficit arose by mites having been lost off the twig, as they had very little chance of escape. The deficit would more probably arise by eggs falling off the twig. Under the circumstances it was decided to assume that the deficit was made up of mites and unhatched eggs in same proportions as existed between the actual number of mites and unhatched eggs counted. The calculations which gave rise to the results were based on this assumption.

Each spray, at each strength tried, was tested on three or four twigs. There were about twelve unsprayed twigs as controls. The results obtained for each spray on the different twigs were very consistent throughout, and the per centage hatch stated below represents approximately the minimum and maximum. The following table summarises the results obtained from the laboratory trials.

LABORATORY TRIALS WITH EGG INFESTED TWIGS.

Spray used.	Percentage strength of Spray.	Time of application of Spray.	Percentage of eggs which hatched (Calculated).
Controls	—	—	80 to 85 (in a few cases up to 90)
Tar-distillate (Carbokrimp)	6	21/1/'30	65 to 70
" " ...	8	21/1/'30	63 to 67
Redolem	4	13/2/'30	34 to 38
"	3	13/2/'30	38 to 43
"	2	13/2/'30	39 to 45
Volck	3	21/1/'30	18 to 20
"	3	26/3/'30	15 to 18
"	2	21/1/'30	30 to 39
"	2	26/3/'30	30 to 35
Lubricating Oil Emulsion	3 (actual oil content).	13/2/'30	15 to 18
" " ...	2 (actual oil content).	13/2/'30	22 to 27
Sunoco	4	21/1/'30	17 to 21
"	4	26/3/'30	15 to 18
"	3	21/1/'30	20 to 27
"	3	26/3/'30	20 to 23
"	2	21/1/'30	39 to 40
"	2	26/3/'30	40 to 42
Sunoco + Carbokrimp ...	4 of Sunoco (in total), 6 of Carbokrimp (in total).	21/1/'30	8 to 10
" " ...	3 of Sunoco (in total), 6 of Carbokrimp (in total).	21/1/'30	9 to 10
" " ...	2 of Sunoco (in total), 4½ of Carbokrimp (in total).	21/1/'30	18
Lubricating Oil Emulsion + Carbokrimp.	3 (actual oil content in total), 6 of Carbokrimp (in total).	21/1/'30	8 to 12
" " ...	2 (actual oil content in total), 6 of Carbokrimp (in total).	21/1/'30	14 to 15

The value of the sprays tested in killing the eggs of the red mite can be readily seen from the foregoing table. The great majority of the eggs on the control twigs hatched out, and on the twigs sprayed with tar-distillate the hatch was also very large. All the oil sprays killed an appreciable number of red mite eggs, and at the greater concentrations gave an efficient measure of control. It will be seen that "Sunoco" at 4 per cent., and "Volck" at 3 per

cent. gave much the same results, the percentage of eggs which hatched in each case being in the neighbourhood of twenty. These sprays gave slightly better results when used as delayed dormant washes than when used in the month of January. The lubricating oil emulsion tested, diluted to 3 per cent. actual oil content, proved slightly better than either "Sunoco" or "Volck" at the greater strengths. "Redolem" did not, however, come up to the standard of the other oil sprays.

It was observed that on the twigs sprayed with the different oil sprays a large proportion of the aphis and sucker eggs hatched out. In some cases the percentage hatch of these insects seemed almost as great as on the control twigs. The oil sprays as a class must accordingly be looked upon as being inefficient in killing the eggs of aphis and sucker.

Special reference must be made to the oil and tar-distillate combination sprays. Two different combinations were used in the present tests, namely, "Sunoco" with "Carbokrimp" and Lubricating Oil Emulsion with "Carbokrimp." A glance at the foregoing table will show that these sprays proved very satisfactory in killing the eggs of the red mite. In this respect they were even better than the oil sprays when used alone. They were also found to be as efficient in killing the eggs of aphis and sucker as the tar-distillates.

The fact that the combination sprays tested were found to combine the egg-killing properties of the oils and tar-distillates is very encouraging and demonstrates that it will be practicable to control at least red mite, aphis and sucker by one winter spraying operation. Further research with such combination sprays will be necessary before very definite recommendations can be made. There is, however, no reason why a spray made up so as to contain say 3 per cent. of "Sunoco" and 6 per cent. of tar-distillate should not, even at this stage, be recommended as a dormant wash where the red mite problem exists. By mixing together equal quantities of 6 per cent. "Sunoco" spray and 12 per cent. tar-distillate spray, a wash of the above composition would result. Seeing that the preparation of the lubricating oil emulsion and tar-distillate combination entails the necessity of making the emulsion and distillate as separate sprays before mixing, and also involves the use of soft water as a diluent, it is not proposed to recommend this combination spray for general use. Doubtless, spray manufacturers will find it practicable to prepare a suitable spray, containing both oil and tar-distillate as constituents, and capable of emulsifying readily with water.

The results of the spraying experiment in the orchard were in close accord with the results obtained from the laboratory trials. No red mites were seen on any trees until about May 1st, although aphis and sucker had commenced to hatch out almost a month earlier. Within a comparatively short time after the hatching of the red mites began, the control trees became very heavily infested, and by the first week in June they were in a deplorable condition. Detailed observations were made on all the sprayed trees from about the middle of May until the middle of June. These observations proved that the combination sprays were better than any of the other sprays tested. Only very few red mites could be found on the trees which had been sprayed with the combina-

tion sprays, and on these trees aphis and sucker were completely absent. On the trees which had been sprayed with Lubricating Oil Emulsion, " Sunoco " and " Volck," the red mite infestation was comparatively slight. From the observations on the trees it would appear that these sprays gave much the same measure of red mite control in the orchard as they did in the laboratory trials. Furthermore, it was seen that they are not by any means efficient in killing the eggs of aphis and sucker. The March spraying with " Sunoco " and " Volck " appeared to give slightly better control of red mite than the corresponding January spraying, but the difference in red mite infestation was not sufficiently pronounced to indicate any marked superiority of the delayed dormant over the earlier applications. ' Redolem " was found to be inferior to the other oil sprays as far as red mite control is concerned.

SUMMARY.

1. It has been shown both by orchard spraying and by laboratory tests that different oil sprays can be relied upon to give a good control of red mite. The relative values of the different oils have been pointed out, and it has been noted that these sprays are more efficient if applied as delayed dormant washes.

2. The experiments carried out have demonstrated the inefficiency of the oil sprays in killing the eggs of aphis and apple sucker.

3. Combination sprays made by mixing certain oils with tar-distillates were tested and gave very promising results. It was found that these sprays gave a better control of red mite than the oil sprays alone, and at the same time were absolutely efficient in killing the eggs of aphis and apple sucker.

4. Directions are given for the preparation of such a combination spray as was used in the experiments, and the fact that aphis, apple sucker and red mite may be controlled by a single dormant spraying is emphasised.

The writers wish to express their thanks to Mr. G. O. Sherrard, Lecturer in Horticulture, for facilitating them in carrying out the orchard spraying experiments at the Albert Agricultural College, Glasnevin.

SUGAR BEET EXPERIMENTS, 1929.

PREVIOUS TRIALS.

Reports on the results of experiments on the cultivation of sugar beet which were conducted by the Department in each of the years 1925, 1926, 1927 and 1928 appeared in the following issues of the Department's Journal: Vol. XXVI., No. 1; Vol. XXVII., No. 1; Vol. XXVIII., No. 1; and Vol. XXIX., No. 1, and also in pamphlet form.

THE 1929 EXPERIMENTS.

In the 1929 season the Department again arranged for the conduct of experiments with sugar beet under the supervision of the Agricultural Instructors, also at the Albert Agricultural College (University College, Dublin) and at the Department's Farms at Athenry, Ballyhaise and Clonakilty. These experiments embraced trials with varieties, manures and lime, and also tests in the cultivation and storing of the crop.

I.—EXPERIMENTS CONDUCTED BY THE AGRICULTURAL INSTRUCTORS.

Variety Trials.

In 1928 the Agricultural Instructors carried out variety trials with four varieties or strains of sugar beet seed. The merits of the varieties Kuhn (P) and Klein-Wanzleben (Z) were tested by comparing each of them with a strain of the same variety, Kuhn (Pa) and Klein-Wanzleben (E) respectively, which it was anticipated would produce an appreciably heavier crop of roots containing a slightly lower percentage of sugar. The average returns from these trials show that the two strains of Kuhn seed, Kuhn (P) and Kuhn (Pa), are almost if not quite the same as regards yield, percentage of sugar in roots, and general appearance. The two strains of Klein-Wanzleben seed, however, differ considerably in these respects and, whilst the (E) strain of this variety produced the better yield this result was counter-balanced to a considerable extent by its lower sugar content. Having regard to these results it was decided to exclude the Kuhn (Pa) variety from the 1929 trials and to replace it with Schreiber (SS) which appeared to be a promising variety for the purpose of these experiments.

In all respects other than those mentioned above the variety trials in 1929 were conducted by the Agricultural Instructors on lines similar to those adopted in the preceding year. The general conditions of the scheme of experiments were as follows :—

(1) That the area of the experimental plot at each centre should be one-quarter statute acre.

(2) That the experimental plot at each centre should be sub-divided into four equal parts and cropped with four varieties of sugar beet, namely,—Klein-Wanzleben (Z), Klein-Wanzleben (E), Kuhn (P), and Schreiber (SS)

(3) That the sugar beet should be grown on land which in the previous season had been under tillage, preferably under corn, save that in districts where it is customary to grow roots after lea the beet might occupy the position usually taken by the root crop.

(4) That sugar beet grown on land which in the previous season had borne a corn crop should be manured with farmyard manure at the rate of about twelve tons per statute acre; and if considered necessary a similar dressing should be given in the case of plots laid down on "manured" land, i.e., land under roots, potatoes or green crop in 1928.

(5) That the following dressing of artificial manures should be applied at the time of sowing the crop, irrespective of the previous crop or manuring—

4 cwt. Superphosphate (35%)	Per statute acre.
4 cwt. Kainit	
1 cwt. Sulphate of Ammonia	

(6) That the land on which the plots were to be laid down should be ploughed deeply, care being taken not to bring to the surface such quantity of subsoil as would adversely affect the growth of the beet.

(7) That the seed bed should be as finely prepared as is customary in the case of the turnip crop.

(8) That each plot should be at least five drills in width and that the width of the drills should not exceed 22 inches.

(9) That the seed should either be dibbled in 9 inches apart or sown at the rate of 18 lb. per statute acre. That the seed should be sown not later in each district than is customary in the case of mangels, or as soon thereafter as a proper seed bed could be prepared.

(10) That the drills should be horse-hoed at least once within a month from the date of sowing the crop and that, if necessary, this operation should be repeated before the crop was singled.

(11) That the plants should be singled to nine inches apart as soon as they had developed four leaves, exclusive of the cotyledons or primary seed leaves.

(12) That subsequent to singling, and until the leaves had met across the drills, the crop should be hand-hoed and horse-hoed as often as might be necessary to check completely the growth of weeds, and to maintain the surface soil in a loose, friable condition.

(13) That the crop should be moulded up when the foliage of the plants had reached such a stage that further cultivation was no longer necessary or practicable.

(14) That the yield of the crop on the various sub-plots should be determined as soon as the crop had reached maturity.

(15) That representative samples drawn from the various sub-plots should be forwarded to the State Laboratory for analysis.

In accordance with this Scheme experiments were conducted at 136 centres throughout the Saorstat. The number of experimental centres in each county is shown in Table I.

TABLE I.

County.	Number of Centres.	
LEINSTER.		
Carlow	4	
Dublin	4	
Kildare	4	
Kilkenny	4	
Laoighis	4	
Longford	4	
Louth	4	
Meath	4	
Offaly	4	
Westmeath	4	
Wexford	4	
Wicklow	4	
	—	48
MUNSTER.		
Clare	7	
Cork	21	
Kerry	8	
Limerick	8	
Tipperary, N.	4	
,, S.	4	
Waterford	4	
	—	56
CONNAUGHT.		
Galway	8	
Leitrim	1	
Mayo	7	
Roscommon	8	
Sligo	2	
	—	26
ULSTER.		
Cavan	2	
Monaghan	4	
	—	6
TOTAL		136

Weather Conditions.

From mid-October 1928, to the 2nd week of January, 1929, the rainfall was excessive. Exceptionally fine weather prevailed during three weeks of January, but wet, unsettled weather which set in on 27th January continued with marked severity until the closing days of February. March and April were remarkably bright, dry and warm months, and rain was much needed when a heavy fall occurred during the latter part of April. In the 1st week of May there were showers, harsh winds and ground frosts ; during the 2nd and 3rd weeks the weather was mild and soft, and the last week of this month was warm and bright. The first three weeks of June were unsettled and cold at times, but the latter part of this month was warm and dry, and these conditions continued until the 4th week of July. From 21st July until the end of August the weather was rather wet and cloudy but fairly warm. All of September and the first three weeks of October were unusually warm, dry and bright. The weather during the ensuing three weeks was rather unsettled and from 10th November, throughout December and January, 1930, as well, the weather continued to be unusually wet and mild.

Preparation of the Land for Seeding.

The weather during three weeks of January and throughout the months of March and April was very favourable for the ploughing and preparation of land for the sugar beet crop. At nearly 70 per cent. of the centres farmyard manure was put in the drills immediately before the seed was sown and at 16 per cent. of the remaining centres the sugar beet crop was grown after a " manured " crop and artificial manures only were applied.

Seeding.

Of the four varieties of seed included in these trials two varieties were obtained from Messrs. Klein-Wanzleben Sugar Factory, Germany, one from Messrs. Kuhn and Co., Naarden, Holland, and one from Messrs. Schreiber and Son, Nordhausen, Germany. Before the seed was despatched to the plotholders representative bulk samples of each of the four varieties were drawn and tested for germination at the Department's Seed Testing Station with the following results :—

Variety.	*Germination per cent.*
Klein-Wanzleben (Z)	184
Klein-Wanzleben (E)	130
Kuhn (P)	158
Schreiber (SS)	140

The weather during the last fortnight of April was quite favourable for the sowing of beet and more than 20 per cent. of the plots was sown during that period. During the first week of May 50 per cent of the plots was sown and sowing was practically complete before the last week of May. As a result of early sowing and favourable weather the germination of the seed was more uniform than in the three previous seasons, and a regular stand of plants was obtained at 96 per cent. of the total number of centres at which trials were conducted.

Singling and After-Cultivation.

Singling of the crop at the majority of centres was carried out when the plants had developed four leaves exclusive of the two primary seed leaves. On the average, the plants reached this stage of growth within six or seven weeks after the date of sowing. The plants at 14 per cent. of the centres were singled within five weeks after the date of sowing and in an equal number of cases the plants were singled more than seven weeks after the date of sowing. As a rule no difficulty was experienced in controlling the growth of weeds and there were no cases of serious neglect of after-cultivation.

Harvesting.

According to the information gained in previous years and also to the results obtained each year since 1925 from fortnightly weighings and analysis of samples of beet drawn at selected centres, the optimum quantity of sugar is attained in November. It was therefore decided to complete, so far as possible in the month of November, the recording of the yield (tonnage) from the 1929 experimental plots and the sugar content of their produce.

The precedure adopted in ascertaining the yield of the crop on the various sub-plots was as follows :—An area of two statute perches representative of the general crop on each sub-plot was accurately measured off. The beets were lifted by hand, with the aid of a fork where necessary. Those which had bolted or were abnormally small were discarded. All loosely adhering soil was removed by scraping the roots with the back of the topping knife, after which the leaves and crown were cut off squarely at the point where the lowest leaf had originally appeared. When the roots from the measured area of two statute perches were scraped and topped, one quarter, by weight, of the roots was selected, having due regard to size and shape. From the roots, so selected, any branches or fangs, or portions thereof, of the thickness of an ordinary lead pencil were cut off, after which each root was thoroughly cleaned by washing and scrubbing. From the weight of such washed roots the " factory weight " for the produce of the whole sub-plot was then calculated.

After the roots had been weighed to ascertain the yield, a representative sample consisting of ten of the topped and washed roots from each sub-plot was despatched to the State Laboratory in Dublin, where, immediately after arrival, each sample was analysed for sugar content in accordance with the usual practice adopted by beet sugar factories.

Of the 136 centres where experiments were laid down, complete returns were obtained from 130 centres. From six centres at which the experiments were conducted reliable records could not be obtained from all the sub-plots for the following reasons :—At one centre in Clare the crop was damaged by leather jackets and crown rot and at another centre in this county the crop was neglected by the grower. At one centre in Galway, and at three centres in Cork, the final weighings were delayed as a result of wet weather and the

crops were lifted or else damaged by live stock before weighings or samples could be obtained.

Detailed particulars in respect of all centres from which complete returns were obtained are shown in Table III., appearing in a report which has been issued as a separate publication, and summaries of the results appearing in that table are shown in Tables II. and IV.

The detailed results shown in Table III. were obtained from 130 centres at which 520 sub-plots were laid down. The average returns from these 520 sub-plots, as shown in Table IV. reveal that the average yield of beet was 12 tons 9 cwts. (factory weight) per statute acre, and the average sugar content of the samples was 17.6 per cent. A comparison of the returns from the two varieties Kuhn (P) and Klein-Wanzleben (Z) shows that on the average the Kuhn (P) variety was slightly superior both in yield and sugar content to the Klein-Wanzleben (Z) variety. A similar comparison of the returns from the two varieties Klein-Wanzleben (Z) and Schreiber (SS) shows that on the average the Klein-Wanzleben (Z) variety was slightly superior in yield to the Schreiber (SS) variety and that there was no difference between the two varieties as regards sugar content. The main object, however, of these variety experiments was to compare the returns from two standard varieties with corresponding returns from related varieties or strains which were expected to produce a heavier crop of roots containing a lower percentage of sugar. In this respect a comparison of the returns from the Klein-Wanzleben types (Z) and (E) shows that the average yield of the Klein-Wanzleben (E) type was 14 cwt. per acre more but the sugar content was 0.4 per cent. less than in the case of the (Z) type of this variety. On the basis of these figures the yield of roots from the (E) type was over 5 per cent. greater than from the (Z) type and allowing for the lower sugar content of the (E) type the yield of sugar per acre therefrom was over 3 per cent. greater than from the (Z) type. On the other hand a comparison of the returns from the varieties Klein-Wanzleben (E) and Kuhn (P) shows that although the yield of Klein-Wanzleben (E) was somewhat greater the higher sugar content of Kuhn (P) fully compensated for its lower yield.

Soils.

It will be observed from Table IV. that at the majority of centres where the experiments were conducted the soil was described as either medium or heavy loam. A comparison of the returns from all centres according to the description of soil on which each crop was grown shows that on the average much the best yield was obtained from soils described as medium loam and that there was little difference in the yields obtained from light and heavy loams or peaty soils. As regards the sugar content of roots the average return from moory soils was appreciably inferior to the returns obtained from the three classes of upland soils. The sugar content of the beet grown on the lighter upland soils was on the average slightly higher than that of the beet

grown on heavier soils. In general, however, such differences would appear to be seasonal and may be attributed to the effects of the moisture content of the soil at critical periods during the growth of the crop.

Influence of place in Rotation.

At the 130 centres from which complete returns were received the sugar beet was grown after a corn crop at 95 centres and after potatoes or a manured root crop at 35 centres. When grown after roots or potatoes the average yield of beet was 12 tons, 13 cwts. and the average sugar content of the roots was 17.5 per cent.; after a corn crop the average yield was 12 tons, 6 cwts. and the average sugar content was 17.6 per cent. Reference to Table IV. shows that beet grown after lea oats was better both in yield and sugar content where the oat crop had received a dressing of artificial manures; also that beet grown after lea oats was better in yield and sugar content than beet grown after a manured crop.

Manuring.

Whilst it will be observed from Table IV. that at a majority of the centres farmyard manure was applied in the drills immediately before the seed was sown, the yield and sugar content of the beet was higher on the average at those centres where farmyard manure was ploughed in during winter. At 14 centres where the standard dressing of artificial manures was applied without the addition of farmyard manure the average yield and sugar content of the beet was slightly above the general average. At ten of these centres the beet followed a root crop or potatoes and at four centres the beet was grown after a corn crop which followed a green crop to which farmyard manure was applied.

Dates of Sowing, Singling and Lifting.

Although the dates of sowing, singling and lifting of the beet at the various centres depended on very different circumstances, comparisons of the average returns from all the centres indicate that the period at which these operations were performed and the length of time between these operations had a marked influence on the yield and, to a less extent, on the sugar content of the beet.

Exactly 50 per cent. of the plots were sown during the first week of May and approximately 25 per cent. were sown either before or after this period. A much better average yield was obtained from the plots sown in April and the plots sown after 7th May produced on the average a slightly better yield than was obtained from the plots sown during the 1st week of May when the weather was relatively unfavourable for the prompt and even germination of beet seed.

The plants at 18 centres, or 14 per cent. of the total number, were singled within a period of 5 weeks after the seed was sown and the average yield at these centres was much better than that obtained at the other centres where the period between sowing and singling exceeded 5 weeks.

At 50 per cent. of the total number of centres the period between the sowing and the lifting of the crops varied from 180 to 200 days, and at these centres the average yield and sugar content of the crop was slightly in excess of the corresponding averages for all centres. At 20 per cent. of the total number of centres the crop was lifted within a period of 180 days from the date of sowing and at these centres the average yield was much below the general average. At the remaining centres a period of more than 200 days elapsed between the sowing and lifting of the crop and at these centres the average yield exceeded the general average for all plots by 1 ton per statute acre, the average sugar content of these crops being somewhat below the general average.

Width of Drills.

At more than 75 per cent. of the total number of centres the width of the drills varied between 21 and 24 inches, and the average yield and sugar content of the crop at these centres were almost exactly equal to the corresponding averages for all centres. At 10 centres, however, where the drills were less than 21 inches in width the average yield was much higher than the general average and at 19 centres where the drills were more than 24 inches in width both the average yield, and the average sugar content of the crop were appreciably below the corresponding averages for all centres.

In no case was the crop described as " very patchy " but at eight centres where the crop was said to be " patchy " the average yield was well below the general average.

Bolting.

The prevalence of bolting in the 1929 crop may be attributed to the checking of growth by harsh, cold winds and frequent night frosts in early May, by low night temperatures in June and by the unusually dry spring and summer which depleted the moisture content of some soils to a remarkable extent. As usual bolting was most prevalent in the case of crops which were sown early. The Kuhn (P) variety produced the smallest number of bolted plants and the Schreiber (SS) variety produced the greatest number. There was practically no difference in the number of bolted plants produced by the two strains of Klein-Wanzleben seed. The 1929 season was the first since the beginning of these experiments that the Kuhn (P) variety showed any appreciable tendency to bolt.

In nearly all cases the shape of the roots was satisfactory, but at a number of centres a rather large proportion was forked. The experiments provide some evidence that forking may be associated with soils of the heavy, peaty and gravelly types. On the other hand, the results indicate that the application of 12 tons of well-rotted farmyard manure per acre in the drills immediately before sowing did not result in the production of an undue proportion of forked roots.

Pests and Diseases.

The crop at almost all centres was remarkably free from attack by insects and other pests. The yield was not materially affected by mangel fly at any centre. Wireworm attacked the crop at two centres where the beet was sown after lea oats and rabbits damaged the crop at one centre. Although crown rot was more widespread in the crops of contract growers than in any previous season this disease was reported as having caused damage at only four of the centres where variety experiments were conducted.

Manurial Experiments.

In view of the general practice regarding the manuring of the sugar beet and mangel crops, it was decided, in the case of the sugar beet experiments conducted by the Department in 1925, that the manurial dressing per statute acre to be applied to all experimental plots should be as follows :—

12 tons farmyard manure.

4 cwt. superphosphate (35 per cent.).

4 ,, Kainit.

1 ,, sulphate of ammonia.

The above mixture of artificial manures gave such satisfactory results when applied to the experimental plots in 1925 that it has been adopted as the standard manurial dressing for both experimental and commercial crops of sugar beet grown since that year. In order, however, to determine whether this standard dressing of artificial manures or some modification thereof was likely to give the most satisfactory results when applied to sugar beet, a series of manurial trials with various mixtures of artificial manures was conducted by the Department in 1926 and somewhat similar series of manurial trials were carried out in 1927 and 1928. The results of these manurial trials in 1926, 1927 and 1928 were included in the reports on the sugar beet experiments in those years which were published in the Department's Journal, Vol. XXVII., No. 1., Vol. XXVIII., No. 1., and Vol. XXIX., No. 1., and also in pamphlet form.

In 1928 a further series of manurial trials was commenced and, as in the previous years, these trials were confined to Counties Carlow, Kildare, Kilkenny, Laoighis, Offaly, Tipperary (N.R.), Waterford, Wexford and Wicklow where the bulk of the supplies of sugar beet for the Carlow factory were grown. The experiments were conducted at four centres in each county, except County Wicklow where the trials were carried out at only two centres. The plots were laid down at almost all centres on land which in the previous season had been cropped with lea oats. In all cases a dressing of farmyard manure was applied uniformly at the rate of 12 tons per statute acre, either during the winter before the land was ploughed or in the drills in the spring. At

each centre three-eighths of a statute acre was divided into six uniform plots, each comprising five drills. The following dressings of artificial manures were applied to the respective plots at each centre :—

Plot.	Manures.	
I.	12 tons farmyard manure	per statute acre.
II.	12 tons farmyard manure 4 cwt. superphosphate (35%) 4 cwt. Kainit. 1 cwt. sulphate of ammonia	per statute acre.
III.	12 tons farmyard manure 5 cwt. superphosphate (35%) 5 cwt. Kainit. 1¼ cwt. sulphate of ammonia.	per statute acre.
IV.	12 tons farmyard manure 6 cwt. superphosphate (35%). 6 cwt. Kainit. 1½ cwt. sulphate of ammonia.	per statute acre.
V.	12 tons farmyard manure. 4 cwt. superphosphate (35%). 4 cwt. Kainit. Nitro-chalk equivalent to 1 cwt. sulphate of ammonia.	per statute acre.
VI.	12 tons farmyard manure. 4 cwt. superphosphate (35%). Muriate of potash equivalent to 4 cwt. Kainit. 1 cwt. sulphate of ammonia.	per statute acre.

The artificial manures were applied immediately before the seed was sown and the Kuhn (P) variety of seed was sown on all the plots at all centres. The general cultivation of the crop on these plots was the same as in the case of the variety trials already referred to. Throughout the growing season it was generally noted that the growth of foliage on Plot I. which received the dressing of farmyard manure only, was not so vigorous as the growth on the other plots and that the foliage was most vigorous on Plots III. and IV. which received the larger quantities of the standard mixture of artificials. At the time when weighings were taken for the determination of yield no difference was noted at 14 centres in the outward indications of ripeness of the crop on the different sub-plots but at most of the other centres the foliage on Plot I. appeared to be the ripest and the foliage on Plot III. and particularly on Plot IV. appeared to be less ripe than that on the other plots.

TABLE No. II.

Showing Average Returns for each County and Province in respect of Centres shown in Table No. III.

Province.	County.	Number of Centres.	Average Yield per Statute Acre (Factory Weight). Klein-Wanzleben Variety. (Z) Strain.		(E) Strain.		Kuhn Variety. (P) Strain.		Schreiber Variety. (SS) Strain.		Average Sugar Content of Roots. Klein-Wanzleben Variety. (Z) Strain.	(E) Strain.	Kuhn Variety. (P) Strain.	Schreiber Variety. (SS) Strain.
			T.	C.	T.	C.	T.	C.	T.	C.	%	%	%	%
LEINSTER ...	Carlow	4	13	10	14	15	14	17	13	15	18·7	17·9	18·7	18·4
	Dublin	4	9	14	11	0	10	0	8	18	17·2	16·2	17·2	16·6
	Kildare ...	4	10	14	11	6	10	16	10	2	18·4	17·8	18·8	18·0
	Kilkenny ...	4	12	17	13	14	14	18	12	19	18·8	18·6	18·6	18·5
	Laoighis ...	4	10	0	11	5	10	9	10	0	18·1	18·2	18·7	18·3
	Longford ...	4	13	11	14	0	14	0	13	7	17·3	16·8	17·3	17·3
	Louth	4	11	10	11	4	10	19	11	5	17·9	17·7	17·9	18·1
	Meath	4	15	0	14	15	14	8	14	18	18·0	17·8	18·7	17·8
	Offaly	4	11	12	13	10	12	10	12	5	18·3	17·6	18·3	18·2
	Westmeath ...	4	11	13	11	6	11	1	9	5	16·8	16·6	17·1	17·2
	Wexford ...	4	11	13	12	12	13	0	11	17	18·1	17·7	17·9	18·3
	Wicklow ...	4	11	3	11	8	11	10	10	16	18·8	17·8	18·6	18·4
MUNSTER ...	Clare	5	13	12	15	13	14	12	13	0	17·9	17·0	17·9	17·8
	Cork	18	13	1	14	3	12	18	13	1	17·9	17·5	18·2	18·0
	Kerry	8	12	3	12	17	13	6	11	17	17·0	16·8	17·1	16·9
	Limerick ...	8	12	14	13	14	14	14	13	8	16·9	16·2	17·0	16·7
	Tipperary N.R. ...	4	10	2	10	18	10	2	9	17	17·1	16·8	17·4	17·5
	Tipperary, S.R. ...	4	18	15	18	3	19	9	17	8	17·8	16·9	17·6	17·4
	Waterford ...	4	16	11	18	3	16	17	16	9	18·5	17·5	18·4	18·2
CONNAUGHT ...	Galway	7	12	3	11	19	12	4	11	9	17·8	17·3	17·9	17·8
	Leitrim ...	1	11	1	11	8	10	15	10	17	15·5	17·2	17·6	17·5
	Mayo	7	9	6	9	11	9	3	9	10	16·4	16·0	16·5	16·9
	Sligo	2	8	19	8	17	8	0	8	9	17·1	17·4	17·8	18·0
	Roscommon ...	8	11	7	11	15	11	3	10	12	16·5	16·4	16·8	16·9
ULSTER ...	Cavan	2	8	12	10	4	10	12	10	11	19·0	17·7	17·6	18·6
	Monaghan ...	4	11	0	11	8	10	14	10	16	18·2	17·4	18·4	18·3
PROVINCIAL AVERAGES :—														
	Leinster ...	48	11	18	12	10	12	6	11	12	18·0	17·5	18·1	17·9
	Munster ...	51	13	8	14	8	14	0	13	5	17·6	17·0	17·7	17·5
	Connaught ...	25	10	16	10	19	10	12	10	8	16·8	16·7	17·1	17·2
	Ulster	6	10	4	11	0	10	13	10	14	18·4	17·5	18·1	18·4
AVERAGES FOR AN SAORSTAT ...		130	12	4	12	18	12	12	12	0	17·6	17·2	17·8	17·6

SHOWING RESULTS OF MANURIAL TRIALS

No.	Name and Address of Plotholder.	Nature of Soil.	Crop grown on land in 1928.	Time of Application of Farmyard Manure.	Date of Sowing.	Date of Singling	"Stand" of Crop.
	CARLOW.						
59	Thorpe, Samuel R., Grange, Tullow ...	Light Loam (Gravelly).	Lea Oats ...	Winter	1 May	31 May	Regular ...
147	O'Neill, Thomas, Ballon, Tullow ...	Medium Loam ...	Lea Oats ...	Winter	6 May	7 June	Regular ...
	KILDARE.						
71	Malone, Simon J., Clonmoyle, Kildare	Clay Loam ...	Lea Oats ...	Spring	6 May ...	22 June ...	Regular ...
85	Broderick, William, Lughill, Monasterevan.	Clay Loam ...	Lea Oats ...	Spring	3 May ...	24 June ...	Regular ...
28	Speirs, Archibald F., Burtown, Athy ...	Heavy Loam ...	Lea Oats ...	Spring	2 May ...	17 June ...	Regular ...
14	Duffy, Patrick, Mountrice, Monasterevan.	Deep Loam ...	Lea Oats ...	Spring	4 May ...	18 June ...	Regular ...
	KILKENNY.						
124	Walsh, John, Ballinalina, Kilkenny ...	Medium Loam ...	Barley ...	Winter	20 May ...	21 June ...	Very Regular.
18	Darcy, James, Ullard, Graiguenamanagh	Medium Loam (Granite)	Barley ...	Winter	6 May ...	12 June ...	Very Regular.
31	Mathers, James, Rathcash, Clifden ...	Medium Limestone Loam.	Oats	Winter	11 May ...	—	Regular ...
26	Dalton, James, Old Grange, Graiguenamanagh.	Medium Loam ...	Oats	Winter	30 April ...	5 June ...	Very Regular.
	LAOIGHIS.						
102	Costelloe, Michael, Upper Lea, Portarlington.	Medium Loam ...	Oats	Spring	6 May ...	19 June ...	Regular ...
87	Campion (jr.), Michael, Clonmeen South, Rathdowney.	Medium Loam ...	Oats	Winter	2 May ...	12 June ...	Regular ...
33	Gowing, Thomas, Kilminchy Heath, Portlaoighise.	Medium Loam ...	Oats	Spring	30 April	18 June ...	Fairly Regular.
20	Dowling, John, Derrydavy, Mountmellick	Peaty Loam ...	Oats	—	29 April ...	10 June ...	Regular ...
	OFFALY.						
97	Kelly, Hugh, Welsh Island, Geashill ...	Medium Loam ...	Lea Oats ...	Spring	6 May ...	20 June ...	Regular ...
125	Doyle, James, Kildangan, Tullamore ...	Stiff Clay ...	Lea Oats ...	Spring	23rd May	3 July ...	Regular ...
116	Costelloe, Richard, Cappagolan, Mount Bolus, Tullamore.	Stiff Clay ...	Lea Oats ...	Spring	22 May ...	29 June ...	Regular ...
103	Foy, John, Welsh Island, Geashill ...	Shallow Clay ...	Lea Oats ...	Spring	6 May ...	22 June ...	Regular ...
	TIPPERARY N. R.						
80	Cross, James P., Norwood, Nenagh ...	Clay Loam ...	Lea Oats ...	Spring	17 May ...	27 June ...	Regular ...
72	Brennan, John, Ballinroe, Templemore	Rich Loam ...	Potatoes	Spring	15 May ...	27 June ...	Regular ...
15	Boylan, Thomas, Croghan, Birr ...	Black Loam ...	Oats	Spring	6 May ...	6 July ...	Regular ...
24	Horan, Hugh, Knockshegowna, Shinrone, Roscrea.	Strong Clay ...	Lea Oats ...	Spring	7 May ...	28 July ...	Regular ...
	WATERFORD.						
154	Morrissey, (Reps.), William, Ballinaskeagh, Dungarvan.	Medium Loam ...	Swedes	Spring	20 May ...	3 July ...	Regular ...
141	Flynn, Patrick, Kilcannon, Cappagh ...	Medium Loam ...	Lea Oats ...	Winter	1 May ...	6 June ...	Regular ...
100	Butler, John, Liccaun, Dunmore E. ...	Medium Loam (Red Sandstone).	Lea Oats ...	Winter	22 May ...	10 June ...	Regular ...
82	O'Brien, Michael, Bewley, Cappoquin	Deep Loam overlying Limestone.	Lea Oats ...	Winter	25 April ...	1–6 June	Regular ...
	WEXFORD.						
104	Mernagh, John, Hillaire Castle, Drinagh	Limestone Clay ...	Lea Oats ...	Winter	23 April ...	10 June ...	Regular ...
88	O'Neil, Patrick, Shanov, Bridgetown ...	Clay Loam ...	Lea Oats ...	Winter	3 May ...	17 June ...	Regular ...
67	Furlong, Thomas, Knockreigh, Adamstown.	Shingly Loam ...	2nd Lea Oats ...	Spring	6 May ...	17 June ...	Regular ...
37	Finn, Thomas, Kellystown, Adamstown	Clay Loam ...	Lea Oats ...	Winter	26 April ...	18 June ...	Regular ...
	WICKLOW.						
152	Burke, Michael, Lockeragh, Baltinglass	Deep Rich Loam	Oats	Spring	14 May ...	17 June ...	Regular ...
79	Kavanagh, James, Kilballyowen, Aughrim	Medium Loam ...	Oats	Spring	1 May ...	26 June ...	Regular ...
	AVERAGE FOR 32 PLOTS ...	—	— —	—			

TABLE No. IV.

Summary of the Average Returns in respect of Centres shown in Table No. III.

	No. of Cases.	Average. Yield of Roots per acre.		Sugar Content of Roots.	Yield of Sugar per acre.
		T.	C.	per cent.	Tons.
Average of All Plots	130	12	9	17·6	2·18
Varieties :					
Klein-Wanzleben (Z)	130	12	4	17·6	2·15
Do. (E)	130	12	18	17·2	2·22
Kuhn (P)	130	12	12	17·8	2·24
Schreiber (SS)	130	12	0	17·6	2·11
Soils :					
Light	21	11	14	17·8	2·08
Medium	52	13	7	17·6	2·35
Heavy	43	11	16	17·5	2·07
Moory	14	11	19	16·9	2·02
Rotations :					
Roots 1927 ; Corn 1928	41	12	2	17·3	2·09
Roots 1928	35	12	13	17·5	2·21
Lea Oats 1928 (manured)	13	12	15	17·9	2·28
Lea Oats 1928 (*no* manure)	41	12	7	17·7	2·19
Manures :					
Farmyard Manure applied in Winter ...	25	13	3	17·7	2·33
Do. do. Spring ...	89	12	3½	17·4	2·12
Do. in *excess of* 12 tons ...	28	12	7½	17·8	2·20
Do. *at rate of* 12 tons pr. ac.	86	12	8	17·6	2·18
Artificials only (where dung was applied to the preceding crop) :					
Standard dressing	14	12	11	18·1	2·27
Do. plus 50 per cent.	2	12	12	17·0	2·14
Dates of Sowing :					
April	30	13	11	17·5	2·37
1st to 7th May inclusive	65	12	0	17·6	2·11
After 7th May	35	12	3½	17·55	2·14
Period of Growth :					
(*a*) *From Sowing to Singling :*					
Up to 35 days, inclusive ...	18	13	11	17·7	2·40
Between 35 and 49 days ...	94	12	3½	17·5	2·13
More than 49 days	18	12	10	17·7	2·21
(*b*) *From Sowing to Lifting :*					
Up to 180 days, inclusive ...	28	10	16	17·6	1·90
From 180 to 200 days, inclusive	65	12	11	17·7	2·22
More than 200 days	37	13	7	17·2	2·30
Width of Drills :					
Less than 21 inches	10	15	1	17·6	2·65
From 21 in. to 24 in. inclusive ...	101	12	7	17·6	2·17
More than 24 inches.	19	11	8	17·0	1·94
Stand of Crops :					
Very patchy	nil.	—		—	—
Patchy	8	10	18	17·3	1·89
Regular	122	12	10	17·6	2·20

No. V.

Conducted by the Agricultural Instructors.

Date of Weighing of Crop.	Date of Analysis of Sample.	Yield per Statute Acre (Factory Weight).												Sugar Content of Roots.					
		Farm-yard manure only.		cwt. 4 Super. 4 Kainit 1 Sulph. Amm.		cwt. 5 Super. 5 Kainit 1¼ Sulph. Amm.		cwt. 6 Super. 6 Kainit 1½ Sulph. Amm.		cwt. 4 Super. 4 Kainit Nitro-chalk.		cwt. 4 Super. Muriate of Potash 1 Sulph. Amm.		Farm-yard manure only.	cwt. 4 Super. 4 Kainit 1 Sulph. Amm.	cwt. 5 Super. 5 Kainit 1¼ Sulph. Amm.	cwt. 6 Super. 6 Kainit 1½ Sulph. Amm.	cwt. 4 Super. 4 Kainit Nitro-chalk.	cwt. 4 Super. Muriate of Potash 1 Sulph. Amm.
				in addition to 12 T. Farmyard Manure.											in addition to 12 T. Farmyard Manure.				
		T.	C.	T.	C.	T.	C.	T.	C.	T.	C.	T.	C.	%	%	%	%	%	%
6 Nov.	9 Nov.	11	14	15	11	15	16	15	13	15	6	15	8	18·5	18·8	18·0	18·7	19·2	18·3
28 Nov.	3 Dec.	14	11	16	8	16	13	17	11	17	14	17	3	18·0	18·0	18·3	18·0	18·0	18·1
7 Nov.	12 Nov.	7	10	9	12	10	2	10	7	9	16	9	19	19·5	19·3	18·7	18·9	18·7	18·2
9 Nov.	13 Nov.	5	14	11	5	11	7	11	19	10	3	10	5	17·5	19·2	19·0	19·0	19·4	19·1
30 Oct.	1 Nov.	9	12	10	18	11	4	11	14	10	13	10	16	18·5	19·4	19·0	19·8	18·5	18·6
28 Oct.	31 Oct.	6	15	11	3	11	7	12	5	11	5	10	17	15·6	17·0	16·2	16·0	17·1	15·1
21 Nov.	25 Nov.	11	4	12	0	13	6	13	0	12	2	12	11	17·7	18·3	18·2	17·4	18·4	18·0
29 Oct.	31 Oct.	12	17	14	16	15	0	14	15	14	5	14	0	18·6	19·0	19·0	19·1	18·7	18·6
31 Oct.	4 Nov.	13	1	14	4	13	11	13	0	14	2	14	16	19·0	19·0	18·4	20·0	20·4	20·0
30 Oct.	1 Nov.	10	3	16	8	15	9	16	12	16	7	16	4	18·4	19·0	20·0	19·5	19·3	19·0
12 Nov.	16 Nov.	9	3	11	3	12	4	12	17	11	10	10	3	17·2	18·0	18·4	17·8	15·4	16·3
6 Nov.	14 Nov.	10	3	13	0	13	6	13	6	13	13	13	2	19·2	18·7	19·1	19·6	19·1	19·2
31 Oct.	4 Nov.	6	14	10	17	12	10	12	19	11	18	10	8	19·1	19·5	20·0	19·1	18·8	19·0
28 Oct.	31 Oct.	12	14	13	15	13	14	13	8	13	14	13	7	18·0	20·2	18·6	20·3	19·0	19·1
14 Nov.	15 Nov.	10	18	14	10	14	14	14	15	14	16	14	13	18·0	18·4	17·5	18·3	18·4	18·0
21 Nov.	25 Nov.	10	0	12	0	12	5	12	12	12	0	12	10	18·9	18·1	17·5	18·0	17·3	18·1
20 Nov.	22 Nov.	9	16	12	14	12	15	12	10	12	8	12	17	18·3	18·4	18·2	18·8	18·8	18·3
15 Nov.	18 Nov.	10	5	13	0	13	6	13	10	12	8	13	4	18·2	18·5	18·6	19·0	19·2	18·8
8 Nov.	13 Nov.	11	6	11	18	13	1	13	18	13	7	12	12	18·0	18·5	18·5	18·0	18·2	18·3
7 Nov.	12 Nov.	11	1	11	3	11	13	12	3	12	7	12	7	18·0	18·1	18·4	19·0	18·6	19·0
29 Oct.	31 Oct.	8	12	9	0	9	3	10	6	9	10	9	12	16·6	17·0	17·1	17·4	16·8	16·7
30 Oct.	1 Nov.	11	10	12	6	12	9	14	9	14	0	12	17	18·7	19·7	19·3	19·0	19·7	19·0
29 Nov.	3 Dec.	10	12	12	18	14	19	14	7	13	3	12	18	18·0	18·0	18·0	18·2	18·0	17·7
22 Nov.	29 Nov.	15	13	17	9	18	9	17	10	17	3	17	3	17·1	18·0	18·1	17·4	17·6	17·3
13 Nov.	16 Nov.	15	0	17	12	17	12	18	0	17	12	17	2	19·1	18·5	19·0	18·6	19·0	18·7
8 Nov.	13 Nov.	16	14	19	5	19	5	19	19	18	3	19	6	18·6	18·6	19·0	18·7	19·0	18·3
18 Nov.	19 Nov.	9	6	11	15	13	9	13	15	11	3	11	9	18·4	21·3	18·6	18·8	18·7	18·6
9 Nov.	14 Nov.	12	0	15	6	15	9	14	15	14	12	15	9	18·6	19·2	19·0	19·0	18·7	18·1
8 Nov.	11 Nov.	13	8	11	0	12	14	12	8	13	6	13	0	18·6	19·0	18·6	18·0	18·3	18·6
4 Nov.	5 Nov.	14	0	13	0	13	10	14	0	14	0	15	0	18·4	19·0	19·5	19·0	18·6	19·0
28 Nov.	3 Dec.	9	5	13	15	14	2	15	1	13	18	13	16	17·2	17·1	17·6	18·0	18·2	18·3
9 Nov.	12 Nov.	6	7	12	3	12	7	13	6	13	4	12	3	17·0	18·5	18·2	18·2	17·7	17·2
—	—	10	17	13	4	13	15	13	19	13	8	13	7	18·1	18·7	18·5	18·6	18·5	18·3

Pests and Diseases.

The crop at almost all centres was remarkably free from attack by insects and other pests. The yield was not materially affected by mangel fly at any centre. Wireworm attacked the crop at two centres where the beet was sown after lea oats and rabbits damaged the crop at one centre. Although crown rot was more widespread in the crops of contract growers than in any previous season this disease was reported as having caused damage at only four of the centres where variety experiments were conducted.

Manurial Experiments.

In view of the general practice regarding the manuring of the sugar beet and mangel crops, it was decided, in the case of the sugar beet experiments conducted by the Department in 1925, that the manurial dressing per statute acre to be applied to all experimental plots should be as follows :—

12 tons farmyard manure.
4 cwt. superphosphate (35 per cent.).
4 ,, Kainit.
1 ,, sulphate of ammonia.

The above mixture of artificial manures gave such satisfactory results when applied to the experimental plots in 1925 that it has been adopted as the standard manurial dressing for both experimental and commercial crops of sugar beet grown since that year. In order, however, to determine whether this standard dressing of artificial manures or some modification thereof was likely to give the most satisfactory results when applied to sugar beet, a series of manurial trials with various mixtures of artificial manures was conducted by the Department in 1926 and somewhat similar series of manurial trials were carried out in 1927 and 1928. The results of these manurial trials in 1926, 1927 and 1928 were included in the reports on the sugar beet experiments in those years which were published in the Department's Journal, Vol. XXVII., No. 1., Vol. XXVIII., No. 1., and Vol. XXIX., No. 1., and also in pamphlet form.

In 1928 a further series of manurial trials was commenced and, as in the previous years, these trials were confined to Counties Carlow, Kildare, Kilkenny, Laoighis, Offaly, Tipperary (N.R.), Waterford, Wexford and Wicklow where the bulk of the supplies of sugar beet for the Carlow factory were grown. The experiments were conducted at four centres in each county, except County Wicklow where the trials were carried out at only two centres. The plots were laid down at almost all centres on land which in the previous season had been cropped with lea oats. In all cases a dressing of farmyard manure was applied uniformly at the rate of 12 tons per statute acre, either during the winter before the land was ploughed or in the drills in the spring. At

each centre three-eighths of a statute acre was divided into six uniform plots, each comprising five drills. The following dressings of artificial manures were applied to the respective plots at each centre :—

Plot.	Manures.	
I.	12 tons farmyard manure	per statute acre.
II.	12 tons farmyard manure 4 cwt. superphosphate (35%) 4 cwt. Kainit. 1 cwt. sulphate of ammonia	per statute acre.
III.	12 tons farmyard manure 5 cwt. superphosphate (35%) 5 cwt. Kainit. 1¼ cwt. sulphate of ammonia.	per statute acre.
IV.	12 tons farmyard manure 6 cwt. superphosphate (35%). 6 cwt. Kainit. 1½ cwt. sulphate of ammonia.	per statute acre.
V.	12 tons farmyard manure. 4 cwt. superphosphate (35%). 4 cwt. Kainit. Nitro-chalk equivalent to 1 cwt. sulphate of ammonia.	per statute acre.
VI.	12 tons farmyard manure. 4 cwt. superphosphate (35%). Muriate of potash equivalent to 4 cwt. Kainit. 1 cwt. sulphate of ammonia.	per statute acre.

The artificial manures were applied immediately before the seed was sown and the Kuhn (P) variety of seed was sown on all the plots at all centres. The general cultivation of the crop on these plots was the same as in the case of the variety trials already referred to. Throughout the growing season it was generally noted that the growth of foliage on Plot I. which received the dressing of farmyard manure only, was not so vigorous as the growth on the other plots and that the foliage was most vigorous on Plots III. and IV. which received the larger quantities of the standard mixture of artificials. At the time when weighings were taken for the determination of yield no difference was noted at 14 centres in the outward indications of ripeness of the crop on the different sub-plots but at most of the other centres the foliage on Plot I. appeared to be the ripest and the foliage on Plot III. and particularly on Plot IV. appeared to be less ripe than that on the other plots.

The procedure adopted with regard to the weighing, sampling and analysis of the produce of these plots was the same as in the case of the variety trials conducted by the Agricultural Instructors, except that plants which had bolted were included in the quantities weighed for the determination of the yield.

Of the 34 centres at which experiments were laid down complete returns are available from 32 centres. Reliable returns could not be obtained from two centres where the crops were very patchy.

Detailed particulars in respect of the 32 centres from which complete returns were obtained are shown in Table V. and a summary of these returns is shown in Table VI.

Although the average yield and sugar content of the crops on Plot I. are much below the corresponding returns from the crops on any of the other plots the satisfactory nature of the returns from Plot I. at the majority of centres indicates that in general the soils selected for these trials were in a good state of fertility. A comparison of the individual returns from all centres shows that a high yield on Plot I. which received farmyard manure only is usually associated with a high sugar content and that in most cases where the sugar content was low the yield was also low. At the 13 centres where the farmyard manure was ploughed in during winter the average yield was 50 per cent. greater and the crop was singled on the average two weeks earlier than at the 18 centres where the farmyard manure was applied in the drills immediately before the seed was sown.

A comparison of the average returns from the other plots in the series shows that the standard manurial dressing applied at the normal rate produced on the average a slightly lower yield but a somewhat higher sugar content than any of the other dressings. As regards the yield of sugar and the value of the crop per acre the average returns from Plots II., V. and VI. are practically equal but the returns from Plot III. are slightly better in both respects and the returns from Plot IV. show a further slight increase. The increased monetary return from Plot II. as compared with Plot I. was at the average rate of £5 per statute acre after allowing for the cost of the standard dressing of artificials applied to Plot II.

The larger quantities of the standard mixture or dressing, *i.e.*, 11¼ cwts. and 13½ cwts. (Plots III. and IV.) as against 9 cwts. (Plot II.) per statute acre produced heavier crops of beet having a slightly lower sugar content. The increased value of the crop on Plots III. and IV. however, more than sufficed, in each case, to defray the cost of the additional manures. In ten cases where the yield from Plot IV. did not exceed the yield from Plot III. the period between the sowing and singling of the crop was short and the yield from the control plot was good—circumstances which indicate that the soil at these centres required only a moderate dressing of artificial manures.

On Plot V. which received nitro-chalk instead of sulphate of ammonia the average yield of the crops was somewhat higher but the sugar content was slightly lower than in the case of the plots to which the standard dressing was applied, and the returns from the different centres afford some evidence that nitro-chalk may prove to be a satisfactory source of nitrogen for sugar beet when grown on land which is deficient in lime.

In the case of Plot VI. which received muriate of potash instead of Kainit the average yield was slightly higher but the sugar content was appreciably lower than in the case of Plot II. which received an equivalent quantity of the standard mixture.

Having regard to the results obtained from the plots to which the standard dressing of 4 cwt. superphosphate, 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre was applied, it is evident that this mixture can be relied upon to give satisfactory returns on most soils, and pending the results of further manurial trials, the Department recommend the use of this mixture with a proviso that a top-dressing of nitrate of soda at the rate of about one cwt. per statute acre should be applied a few days after the crop is singled, or even before singling, where the crop is attacked by insect pests or where growth has been seriously interfered with through adverse weather conditions or other causes.

[TABLE VI.

TABLE No. VI.

SUMMARY OF THE AVERAGE RETURNS IN RESPECT OF CENTRES SHOWN IN TABLE No. V.

Plot No.	Manurial Treatment.				Yield per Stat. Acre factory weight.	Sugar Content.		Contract price of beets per ton.	Value of Crop per acre.	Increased Return per acre as compared with Plot I.	Cost of Artificial manures per Stat. Acre.	Net Increase in Returns per Stat. Acre as compared with	
	Farmyard manure.	Phosphate.	Potash.	Nitrogen.		Percentage in roots.	Weight per acre.					Plot I.	Plot II.
	Tons.	cwt.	cwt.	cwt.	T. C.	per cent.	Tons.	s. d.	£ s d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	12	—	—	—	10 17	18·1	1·96	52 6	28 9 8	—	—	—	—
2	12	4 cwt. (35%) Superphos.	4 cwt. Kainit.	1 cwt. Sul. Amm.	13 4	18·7	2·47	54 0	35 12 10	7 3 2	2 2 0	5 1 2	—
3	12	5 cwt. Superphos.	5 cwt. Kainit.	1¼ cwt. Sul. Amm.	13 13	18·5	2·53	53 6	36 10 3	8 0 7	2 12 6	5 8 1	0 6 11
4	12	6 cwt. Superphos.	6 cwt. Kainit.	1½ cwt. Sul. Amm.	13 19	18·6	2·59	53 9	37 9 10	9 0 2	3 3 0	5 17 2	0 16 0
5	12	4 cwt. Superphos.	4 cwt. Kainit.	149 lbs. Nitro-chalk.	13 8	18·5	2·48	53 6	35 16 11	7 7 3	2 5 7	5 1 8	0 0 6
6	12	4 cwt. Superphos.	125½ lbs. Muriate of potash.	1 cwt. Sulphate of Ammonia.	13 7	18·3	2·44	53 0	35 7 6	6 17 10	1 17 2½	5 0 7½	0 0 6½ (decrease)

II.—EXPERIMENTS AT THE DEPARTMENT'S FARMS AND AT THE ALBERT AGRICULTURAL COLLEGE (UNIVERSITY COLLEGE, DUBLIN).

During the season of 1929 experiments with sugar beet were conducted at the Department's farms at Athenry, Ballyhaise, and Clonakilty and also at the Albert Agricultural College, Glasnevin. These experiments comprised variety tests and, in addition, a series of trials arranged to determine the effects of :—

(1) The application of burnt lime in winter.

(2) The application of nitrate of soda in drills at time of sowing and as a top-dressing after singling.

(3) Sowing the crops in rows or drills of different widths.

(4) Singling the crops at different stages of growth.

The experiments conducted at the above mentioned centres in 1929 were arranged as follows :—

PLAN OF EXPERIMENTS.

	Lime.		No Lime.		
Varieties	10 Drills	... Kuhn (P)	Variety		Variety Experiments.
	10 ,,	... Klein-Wanzleben (Z)	,,		
	10 ,,	... Klein-Wanzleben (E)	,,		
	10 ,,	... Schreiber (SO)	,,		
	10 ,,	... Schreiber (SS)	,,		
	10 ,,	... Buszczynski (NP)	,,		
	10 ,,	... Garton (A)	,,		
	10 ,,	... Johnson's Perfection	,,		
	10 ,,	... Marsters (BH)	,,		
Width of Drills.	6 ,,	21″ Drills.	Singled, 9″ apart.		Manurial and Cultivation Experiments.
	6 ,,	24″ ,,	,, 9″ ,,		
	6 ,,	18″ ,,	,, 9″ ,,		
Singling at Different Stages of Growth.	5 ,,	21″ ,,	Singled at the "two-leaf" stage of growth.		
	5 ,,	21″ ,,	,, ,, "four-leaf" stage of growth.		
Methods of Applying Nitrate of Soda.	5 ,,	4 cwt. Super. 35%, applied in drills at time of sowing 4 cwt. Kainit, ,, ,, ,, 1 cwt. Sulphate of Ammonia ,, ,, 1 cwt. Nitrate of Soda ,, ,,		per statute acre.	
	5 ,,	4 cwt. Super. 35%, applied in drills at time of sowing 4 cwt. Kainit, ,, ,, ,, 1 cwt. Sulphate of Ammonia ,, ,, 1 cwt. Nitrate of Soda applied as a top-dressing after singling.		,,	
	5 ,,	4 cwt. Super, 35%, applied in drills at time of sowing. 4 cwt. Kainit, ,, ,, ,, 1 cwt. Sulphate of Ammonia, ,, ,,		,,	
	5 ,,	4 cwt. Super. 35%, applied in drills, at time of sowing. 4 cwt. Kainit, ,, ,, ,, 149 lb. Nitrate of Soda ,, ,,		,,	
	5 ,,	4 cwt. Super. 35%, applied in drills at time of sowing 4 cwt. Kainit, ,, ,, ,, 149 lb. Nitrate of Soda ,, ,, 1 cwt. Nitrate of Soda, applied as a top-dressing after singling.		,,	

The following procedure was adopted in laying down the experiments at each centre. A plot measuring one statute acre and another plot of half this size were marked off at each centre. The half-acre plot was set aside for cultivation tests and trials with artificial manures while the one-acre plot was reserved for variety trials and a comparative test of the effects of burnt lime when applied to the land in winter before the crop was sown. The two plots were dressed uniformly with well rotted farmyard manure applied at the rate of 15 tons per statute acre. The plot intended for variety trials was divided into two equal portions, by a line parallel to the longer dimension, and one half was dressed with burnt lime at the rate of 30 cwts. per statute acre before the land was ploughed in winter. In preparing the land for the sowing of the seed in the variety trials the drills were made across both sub-divisions of the one acre plot. On the adjoining half acre plot the other tests as previously described and as shown in the Plan of Experiments were carried out with seed of the Kuhn (P) variety.

Trials with Varieties and Lime.

The one acre plot at each centre reserved for variety trials, half of which had received a dressing of burnt lime in winter, was sown with nine varieties, viz. :—Kuhn (P), Klein-Wanzleben (Z), Klein-Wanzleben (E), Schreiber (SO), Schreiber (SS), Buszczynski (NP), Garton (A), Johnson's (Perfection) and Marsters' (British Hilleshog). A dressing of 4 cwt. superphosphate (35 per cent.), 4 cwt. kainit and 1 cwt. sulphate of ammonia per statute acre was applied at each centre to the entire plot at the time of sowing. At all centres the drills were 21 inches in width, and the seed was dibbled in by hand to allow exactly 9 inches between the plants when singled. At each centre 12 drills were sown with each of the eight varieties of seed.

The general cultivation, weighing, sampling and analysis of the crop on these plots were the same as in the case of the variety trials carried out by the Agricultural Instructors already described in this report. At the Ballyhaise centre, where the soil is heavy and rather acid the crop grew slowly and unevenly in its early stages, but it made good progress later in the season. At the other three centres the crops on all the plots developed normally and at no centre were the plants injured to any serious extent by pests or diseases. At the Glasnevin centre, however, the disease known as "leaf brown" caused the leaves of the plants to turn yellow at the end of the third week of August and appeared to check growth to some extent. At none of the centres was there any apparent difference during the growing season in the crops on the limed ~~and~~ unlimed plots.

Particulars as to the yield and sugar content of the beet on the various sub-plots at each centre which received the dressing of lime and on the corresponding sub-plots to which no lime was applied are shown in Tables VII. and VIII. respectively.

[TABLES.

TABLE No. VII.

Returns from Plots to which Lime was Applied.

Variety.	Yield per Statute Acre.								Sugar Content of Roots.				Average yield.		Average Sugar Content.
	Athenry.		Bally-haise.		Clona-kilty.		Glas-nevin.		Athenry.	Bally-haise.	Clona-kilty.	Glas-nevin.			
	T.	C.	T.	C.	T.	C.	T.	C.	%	%	%	%	T.	C.	%
Kuhn (P)	16	14	11	14	13	17	18	13	17·0	17·8	18·0	16·5	12	15	17·3
K.W.O. (Z)	13	7	12	19	13	11	8	9	17·1	16·6	18·0	16·2	12	2	17·0
K.W.O. (E)	15	17	12	10	18	17	8	6	15·7	15·8	17·0	15·4	13	18	16·0
Schreiber (SS).	10	10	11	6	14	14	7	0	16·16	15·7	17·9	16·0	10	18	16·8
Schreiber (SO).	12	17	12	10	15	11	8	7	16·2	17·0	17·5	15·4	12	6	16·5
Marsters ...	13	0	10	15	16	14	9	10	17·1	16·4	17·8	16·3	12	10	16·9
Garton ...	13	0	12	0	20	17	9	0	15·0	15·2	16·7	16·7	13	14	15·9
Johnston (P)	13	17	11	0	15	14	9	3	17·0	17·1	17·9	16·5	12	9	17·1
Buszczynski (NP).	16	6	10	3	17	0	9	6	15·4	15·6	17·4	15·4	13	4	16·0

TABLE No. VIII.

Returns from Plots to which no Lime was Applied.

Variety.	Yield per Statute Acre.								Sugar Content of Roots.				Average yield.		Average Sugar Content
	Athenry		Bally-haise.		Clona-kilty.		Glas-nevin.		Athenry	Bally-haise.	Clona-kilty.	Glas-nevin.			
	T.	C.	T.	C.	T.	C.	T.	C.	%	%	%	%	T.	C.	%
Kuhn (P)	13	10	10	14	12	9	12	1	17·0	17·8	18·6	16·0	12	4	17·3
K.W.O. (Z)	13	10	11	9	15	3	11	15	16·4	16·6	17·6	16·4	12	19	16·7
K.W.O. (E)	13	16	13	0	18	6	9	15	15·1	15·8	17·2	15·0	13	14	15·8
Schreiber (SS).	14	0	11	0	14	11	9	0	16·3	15·7	18·2	16·0	12	3	16·5
Schreiber (SO).	14	0	12	0	15	9	10	0	17·1	17·0	17·7	16·4	12	17	17·0
Marsters ...	11	11	11	5	16	9	10	10	16·7	16·4	18·2	16·3	12	6	16·9
Garton ...	14	0	12	0	16	14	10	0	15·4	15·2	17·3	16·4	13	4	16·1
Johnston (P)	15	9	10	2	15	0	8	1	16·2	17·1	17·6	15·8	12	3	16·7
Buszczynski (NP).	17	3	10	11	17	11	10	12	15·0	15·6	17·2	15·0	13	10	15·7

TABLE No. IX.

AVERAGE OF THE RETURNS FROM THE VARIETY TRIALS SHOWN IN TABLES VII. AND VIII.

VARIETY.	Average Yield of Roots per statute acre (net factory weight).	Average Sugar Content of Roots.	Average Weight of Sugar per statute acre.	Bolted Plants.
	Tons.	per cent.	Tons.	per cent.
Kuhn (P)	12·48	17·30	2·16	1·23
Klein-Wanzleben (Z)	12·48	16·85	2·10	2·70
Klein-Wanzleben (E)	13·80	15·90	2·19	2·77
Schreiber (SS) ...	11·53	16·65	1·92	4·22
Schreiber (SO) ...	12·58	16·75	2·11	4·66
Buszczynski (NP) ...	13·58	15·82	2·14	8·67
Garton (A) ...	13·43	16·00	2·15	7·43
Johnson (P) ...	12·30	16·90	2·08	0·78
Marsters (BH) ...	12·40	16·90	2·09	2·63

TABLE No. X.

AVERAGE OF THE RETURNS FROM THE LIMING TRIALS SHOWN IN TABLES No. VII. AND VIII.

CENTRE.	Hydrogen-ion Concentration of soil and sub-soil.	Yield per Statute Acre (factory Weight).				Sugar Content of Roots (per cent.).		Weight of Sugar (per acre).	
	NO Lime.	Lime.		NO Lime.		Lime.	NO Lime.	Lime.	NO Lime.
	P.H.	T.	C.	T.	C.	per cent.	per cent.	Tons.	Tons.
Ballyhaise ...	5·2	11	13	11	7	17·0	16·4	1·98	1·86
Clonakilty ...	6·5	16	6	15	15	17·6	17·7	2·87	2·79
Athenry ...	7·6	13	19	14	2	16·3	16·1	2·27	2·27
Glasnevin ...	7·5	8	13	10	4	16·0	15·9	1·38	1·62
Average ...		12	13	12	17	16·7	16·5	2·13	2·14
Average of,— Ballyhaise and Clonakilty.		14	0	13	11	17·30	17·05	2·42	2·31
Athenry and Glasnevin.		11	6	12	3	16·15	16·00	1·82	1·94

A comparison of the average returns from the variety trials (Table IX.) shows that the lowest average yield of roots and sugar was produced by the Schreiber (SS) variety and that the other varieties may be divided into two groups which correspond to two recognised classes of sugar beet varieties distinguished by their yields and sugar content. Group I. comprising the varieties Kuhn (P.), Klein-Wanzleben (Z), Schreiber (SO), Marsters (BH) and Johnson (P) produced crops of higher sugar content but lower yield than group II. comprising the varieties Klein-Wanzleben (E), Buszczynski (NP) and Garton (A). The average returns from the varieties in the first group are very similar but Kuhn (P) proves to be the superior variety on account of its higher sugar content. There is also little difference in the returns from the three varieties in the second group, but Klein-Wanzleben (E) may be regarded as the superior variety as a result of its higher yield per acre of roots and sugar, and lower percentage of bolted plants.

The returns from all the sub-plots at the four centres which received a dressing of lime (Table VII.) when compared with the corresponding returns from the sub-plots to which no lime was applied (Table VIII.) indicate that on the average the lime dressing had little effect on the yield and sugar content of the crop and practically no effect on the weight of sugar per acre. From Table X., however, it will be observed that this result was due to the negative effects of the lime dressing at the Athenry and Glasnevin centres. At the Ballyhaise centre the average yield and sugar content of the crops on the lime plot were better and at the Clonakilty centre the average yield was higher than the corresponding returns from the plots to which no lime was applied. At neither centre, however, was the cash value of the crop increased sufficiently by liming to pay for the cost of the material.

The figures in the second column of Table X. refer to the hydrogen-ion concentration of each soil, which is a measure of the active acidity of the soil. A soil is regarded as neutral at PH 7.0 and in this country it has been found that beet may be grown safely on soils between the values of PH 5.3 and PH 7.8 but the most satisfactory results are usually obtained about PH 6.5. It would appear that the sugar beet crop will, as a rule, benefit from the application of lime to soils below PH 6.5 and that the beet crop is likely to be affected adversely, if at all, by the application of lime to soils above PH 7.0.

Nitrate of Soda Applied in Drills at Time of Sowing and as a Top-dressing.

Withthe object of comparing the effects of nitrate of soda, when applied in the drill at the time the sugar beet seed is sown and when applied as a top-dressing immediately after the crop is singled, a series of plots was laid down at each centre as shown on the Plan of the Experiments. This series of plots was also designed to afford a comparison of the values of sulphate of ammonia and nitrate of soda when used for sugar beet along with superphosphate and kainit. As regards cultivation all plots were, of course, treated in identical manner, and during the growing season no difference was observed in the general appearance of the plants on the different plots. The returns from the plots at each centre are shown in Table XI.

TABLE XI.

Artificial Manures applied per Statute Acre.	Yield per Statute Acre (Factory Weight).				Sugar Content of Roots.				Average.	
	Athenry	Ballyhaise	Clonakilty	Glasnevin	Athenry	Ballyhaise	Clonakilty	Glasnevin	Yield (Factory Weight)	Sugar Content
	T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
1. 4 cwt. Superphospate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied in the drills at time of sowing.	15 1	11 10	15 4	10 10	16·8	17·8	17·6	16·5	13 1	17·2
2. 4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied as a top-dressing after singling.	13 0	13 4	15 9	10 12	16·4	17·5	17·4	16·2	13 1	16·9
3. 4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing.	13 14	12 10	15 9	9 16	16·6	16·2	18·1	16·1	12 17	16·7
4. 4 cwt. Superphosphate 35% applied in the drills at time of sowing 4 cwt. Kainit applied in the drills at time of sowing. 149 lb. Nitrate of Soda applied in the drills at time of sowing.	13 1	14 0	13 11	9 1	16·5	16·7	17·7	16·5	12 8	16·9
5. 4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 149 lb. Nitrate of Soda applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied as a top-dressing after singling.	15 7	13 10	15 0	9 18	16·4	17·0	18·3	16·0	13 9	16·9

As the returns from the comparable plots are not very uniform at the four centres it would be advisable to await the completion of three years' trials at each centre before drawing any conclusions in regard to this series of trials. It would, however, appear that the most satisfactory period for the application of nitrate of soda and its effect on the beet crop as compared with that of sulphate of ammonia are matters which are affected to a great extent by variations in soil and season.

Width of Drills.

As in the three previous seasons, a series of plots in which the drills were of varying width, was laid down at each centre. The general arrangement of the plots was as shown on the Plan of the Experiments. In all respects, except in the width of the drills, the crop on the plots was treated in exactly the same manner as that on the sub-plots in the variety trials, conducted at the same centres, to which no lime was applied. From one centre it was

reported that when the final weighings were taken the roots grown on the 18-inch drills were perceptibly smaller than those grown on the wider drills. At another centre the final horse-hoeing at the end of July had to be omitted in the case of the 18-inch drills for the reason that the leaves had then met between these rows. The results of these trials are shown in Table XII.

TABLE XII.

Centre.	Yield per Statute Acre (Factory Weight).			Sugar Content of Roots.		
	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.	18-Inch Rows.	21-Inch Rows.	24-Inch Rows.
	T. C.	T. C.	T. C.	%	%	%
Athenry ...	16 4	12 10	13 9	17·3	17·1	18·0
Ballyhaise ...	12 3	11 12	11 0	16·3	16·2	17·2
Clonakilty ...	15 17	13 6	13 6	18·2	18·4	18·0
Glasnevin ...	10 19	9 3	8 13	16·8	16·2	16·1
Average (Four Centres).	13 16	11 13	11 12	17·2	17·0	17·3

At each of the four centres the crop grown on 18 inch drills produced the highest yield and there was practically no difference in the average yield of the crops when grown on 21 inch and 24 inch drills. There was no significant difference in the average sugar content of the crop when grown on drills of different widths.

Singling at Different Stages of Growth.

Plots on which the plants were singled at the stage when they had developed two rough leaves and four rough leaves, respectively, were again laid down at each centre. Save that these plots were singled at different stages of growth they received exactly the same treatment.

The results in regard to yield and sugar content are shown in Table XIII.

TABLE XIII.

Centre.	Yield per Statute Acre (Factory Weight).		Sugar Content of Roots.	
	Plants singled at two-leaf stage	Plants singled at four-leaf stage	Plants singled at two-leaf stage	Plants singled at four-leaf stage
	T. C.	T. C.	%	%
Athenry	13 9	14 4	17·2	16·2
Ballyhaise	10 8	11 6	17·1	17·0
Clonakilty...	13 0	14 0	18·2	18·1
Glasnevin	9 12	10 0	16·0	16·7
Average	11 12	12 7	17·1	17·0

It will be observed that at all centres the yields from the crops singled when four rough leaves had developed were better than the yields from those singled when only two rough leaves had grown. On the average, however, the crops had the same sugar content.

III.—OTHER EXPERIMENTS.

Trials with Lime on Very Acid Soils.

A number of trials in the liming of land for the sugar beet crop have been carried out in this country since 1925 without ascertaining beforehand whether the soils on which the crops were grown were in need of lime. In the circumstances the results obtained from the applications of lime at different centres were rather conflicting, probably, for the reason that in some cases the soil already contained an abundant supply of lime.

Investigations carried out during the past two years by Dr. P. H. Gallagher of University College, Dublin, have shown that certain failures to which the sugar beet crop is liable are correlated with pronounced acidity of the soil and that the hydrogen-ion concentration, or PH value, of soils is a reliable index of their lime requirements for the growing of sugar beet. In view of these facts arrangements were made in 1929 with the Agricultural Instructor for Co. Wexford, to conduct two trials and with the Irish Sugar Manufacturing Co., Ltd., to conduct one trial in the liming of acid soils below PH 5.0. On the three farms selected for these trials very poor crops of beet had been grown in the previous season and the cause of the failures had been traced to extreme soil acidity.

Arrangements for the trials were not made in time to apply a heavy dressing of lime in the winter and, moreover, it was desired, as an alternative, to test the effects of applying a dressing of one ton of lime at the time the land was being finally prepared for the sowing of the seed. The procedure adopted in carrying out the experiments was as follows :—

In each field a representative plot of ground was measured off and was dressed before the drills were raised with burnt lime, either ground or freshly slaked, at the rate of one ton per statute acre. The measured area in each field, as well as a similar area alongside to which no lime was applied, was sown with sugar beet early in May, 1929, and subsequently the two plots were treated in exactly the same manner. At each centre the standard dressings of farmyard and artificial manures were applied, and the methods of after-cultivation, weighing and sampling of the crop on the different plots were the same as in the case of the variety experiments conducted by the Agricultural Instructors.

At one centre the crop was reported as being somewhat patchy and at all three centres the plants on the limed plots were more healthy in the seedling stage and more vigorous throughout the season than were the plants on the unlimed plots.

The returns from the different centres are shown in Table XIV.

TABLE XIV.

Showing The Results at Three Centres where One Ton of Lime was applied to Very Acid Soils.

Name and Address of Plotholder.	Nature of Soil.	Yield per Statute Acre (factory weight). Lime.		Yield per Statute Acre (factory weight). NO Lime.		Sugar Content of Roots. Lime.	Sugar Content of Roots. NO Lime.	Cash Value of Crop per Statute Acre. Lime.			Cash Value of Crop per Statute Acre. NO Lime.		
		T.	C.	T.	C.	per cent.	per cent.	£	s.	d.	£	s.	d.
Furlong, T., Knockreigh, Adamstown, Co. Wexford.	Shingly Loam.	14	0	11	0	18·0	19·0	36	11	6	30	2	3
Kehoe, P., Gloncarrog, Enniscorthy, Co. Wexford.	Clay Loam.	9	3	6	0	17·5	18·0	23	6	8	15	13	6
Carroll, P., Haroldstown, Tobinstown, Co. Carlow.	Sandy Loam.	12	2	10	12	17·2	17·6	30	8	0	27	3	3
Average ...		11	15	9	4	17·6	18·2	30	2	1	24	6	4

The yields on the limed plots at all centres were better than those on the unlimed plots and although the sugar content was not so high in any case on the limed plots the average cash value of the crop on the limed plots as compared with that on the unlimed plots showed a very profitable return on the outlay for lime.

Experiments in the Storing of Sugar Beet.

Experiments in the storing of sugar beet which have been in progress since 1926 were continued in the winter season of 1929-30.

At each of the Department's farms at Athenry, Ballyhaise, and Clonakilty, during the month of November, about 3 tons of properly crowned and washed sugar beet were weighed carefully and stored immediately thereafter in a

clamp. The clamp at each centre was 4 feet high, relatively narrow and long, and was covered loosely with a layer of wheaten straw approximately 6 inches in depth. At the beginning of the following February, after the roots had been in storage for approximately 10 weeks, the entire quantity of roots was again weighed in order to ascertain the loss in weight. At the beginning and the end of the period representative samples of the roots in each clamp were tested for sugar content and for purity of juice.

At Carlow the Irish Sugar Manufacturing Company, Ltd., co-operated with the Department by affording the necessary facilities for carrying out a more elaborate experiment than those conducted at the Department's Farms. The object of this experiment was similar to that of the trials described above and in addition it was arranged to test the effects on the weight and sugar content of beet when it was stored in clamps which differed as regards their aspect to sun and wind and also as to the nature of their covering.

These experiments, intended to determine the effects of storing beet in different seasons and under different conditions, are being continued and a detailed report will be deferred until the completion of the trials. The results so far obtained show :

(1) That in the case of beet stored over a period of 8 to 10 weeks in the ordinary narrow clamp covered lightly with straw there has been a decrease of sugar amounting, on the average, to approximately 6 per cent. of the total weight of sugar in the beet, and that such loss can be further reduced by storing the beet in a narrow clamp, sheltered from wind and sun and covered with a light layer of straw just sufficient in depth to hide the roots from view.

(2) That a single layer of fresh beet tops provides a satisfactory covering for stored beet if the period of storage does not exceed one month.

SUMMARY OF THE RESULTS OF THE PRINCIPAL EXPERIMENTS WITH SUGAR BEET CONDUCTED IN THE YEAR 1929.

(1) In the variety experiments conducted by the Agricultural Instructors the Kuhn (P) variety was slightly superior both in yield and sugar content to the Klein-Wanzleben (Z) variety. The Schreiber (SS) variety was inferior as regards yield, but equal as regards sugar content to the Klein-Wanzleben (Z) variety. The (E) strain of the Klein-Wanzleben variety produced a yield slightly higher than that of the (Z) strain of this variety but this result was counter-balanced to a considerable extent by the lower sugar content of the (E) strain. The Kuhn (P) variety was superior to the other three varieties as regards the yield of sugar and the cash value of the crop per acre.

(2) In the manurial trials conducted by the Agricultural Instructors the standard dressing of artificial manures consisting of 4 cwt. superphosphate (35%), 4 cwt. kainit, and 1 cwt. sulphate of ammonia per statute acre, applied immediately before sowing the sugar beet seed, gave quite satisfactory returns as compared with the results obtained from certain modifications of this dressing ; but the application of additional quantities amounting to 25 per cent. and 50 per cent. of the standard dressing gave profitable increases in the average value of the crop per acre.

(3) A dressing of lime at the rate of 30 cwts. per statute acre applied to the land in the winter before beet was grown, increased very slightly the average yield and sugar content of the crops, but where the soil was badly in need of lime, as indicated by the hydrogen-ion concentration of the soil, a dressing of even one ton of lime applied at the time the land was being prepared for sowing gave a profitable increase in the returns.

(4) The best results were obtained where the crop was grown on 18 inch drills, and the plants were singled at the stage when they have developed four rough leaves.

(5) The results of experiments in the storing of beet indicate that, in the case of beet stored over a period of 8 to 10 weeks in the ordinary narrow clamp covered lightly with straw, there is a decrease of sugar amounting to approximately six per cent. of the total weight of sugar in the beet, and that such loss can be further reduced by storing the beet in a narrow clamp sheltered from sun and wind and covered with a layer of straw just sufficient in depth to hide the roots from view.

THE COMPOSITION OF IRISH WINTER BUTTER, 1928-29.

BY P. S. ARUP, M.SC. (LOND.), F.I.C., A.C.G.I.

A series of analyses similar to that for the winter season of 1927-8 was carried out for the season 1928-9. The results confirm those previously obtained, so that a brief summary will suffice. Out of a total of 270 samples, representing 36 creameries and 3 agricultural schools, taken from November 1st, 1928, to February 23rd, 1929, those showing R.M. values below 24 were as follows:—

Reichert Meissl Value.

R.M.	No. of Samples.	Percentage.	Date of Samples.
Below 20	Nil	Nil	
20—20·9	3	1·1	5/12/28 to 17/12/28
21—21·9	17	6·3	19/11/28 to 3/1/29
22·0—22·9 ...	34	12·6	1/11/28 to 18/1/29
23·0—23·9 ...	34	12·6	1/11/28 to 25/1/29
Total ...	88	32·6	5/12/28 to 25/1/29

The average figures for fortnightly periods were as follows:—

Period.	No. of Samples.	Average.	
		R.M.	Pol.
November 1st—15th	28	24·2	1·69
,, 16th—30th	37	23·3	1·61
December 1st—15th	32	22·9	1·63
,, 16th—31st	31	23·5	1·78
January 1st—15th	34	25·5	1·85
,, 16th—31st	36	26·5	1·79
February 1st—13th	28	27·0	1·75
,, 14th—23rd	30	26·3	2·00

The unusually cold weather which prevailed all over the country from the 11th to the 17th of February had no noticeable effect in checking the upward tendency of the R.M. values, and it may be concluded that the predominating factor influencing those values is the lactation period.

Polenske Value.—The minimum recorded was 1.30 in connection with R.M. values of 21.1 and 24.9. The maximum was 3.40 with R.M. of 29.2. All the Polenske values taken in connection with their corresponding R.M. values fell within the limits generally laid down in the literature for genuine butter. When the R.M. values increase during the early part of the year, the Polenske values do not increase at the same proportionate rate, and are thus somewhat below the average. In the case of the samples from the three Agricultural Schools, however, the Polenske values were higher, and, generally speaking, about the normal. In these particulars the experience of last year is confirmed.

Kirschner Value.—This was determined on 136 samples, mostly those having R.M. vlaues below 24, and was found to vary from 67.3 to 81.2 when expressed as a percentage of the corresponding R.M. value. It was not found possible to trace any connection between these variations and any other factor.

Brine, Soluble and Insoluble Values.—Those were determined by Elsdon and Smith's modification of Gilmour's method (*Analyst, 1927, p. 317*). The distillation process is the same as in the R.M. Pol. process, except that 100 c.c. are distilled instead of 110 c.c., so that the total volatile acids were consistently lower than in the R.M. process. In order to ascertain whether the salting out process gives more consistent results than the usual method, the following comparisons were made:—70 samples showed ordinary Polenske values varying from 5.5 to 10.4 per cent. of the total volatile acids, and brine insoluble values from 10.1 to 23.8 per cent. The seven highest and seven lowest Polenske percentages varied from 5.5 to 5.8, and from 8.3 to 10.4 respectively, while the corresponding percentage figures for the brine insoluble were 10.1 to 12.0 and 17.7 to 23.8 respectively.

The following table shows some typical results obtained with butter of low R.M. values; the brine insoluble values are about twice the Polenske values, as Elsdon and Smith found to be the case with butters of higher R.M. values. The brine soluble values are slightly higher than the corresponding Kirschner values. As a measure of the volatile acids in pure butter, the brine method does not appear to offer any particular advantages over the R.M. Polenske method, but there is a possibility that it might do so in the case of mixtures containing palm nut or coconut oils. The method was of course primarily designed for the estimation of butter in margarine, and for this purpose it offers some advantages over the Kirschner method, being simpler and less liable to experimental error.

[TABLE.

Date of Sample.		R.M.	Pol.	Kirsch.	Kirsch as % of R.M.	Brine.		Refractur Index—Zeiss° at 40_2 C.°
						Sol.	Insol.	
5/12/28	...	20·8	1·50	16·2	77·9	17·6	3·20	46·9
17/12/28	...	20·7	1·70	14·5	70·0	17·6	2·35	46·6
,,	...	20·8	1·50	14·5	69·7	17·3	2·55	46·9
19/11/28	...	21·8	1·35	16·1	74·0	19·0	2·55	45·2
26/11/28	...	21·5	1·45	16·0	74·3	17·9	2·55	47·0
1/12/28	...	21·3	1·40	16·4	76·9	18·4	2·20	46·9
3/12/28	...	21·8	1·50	15·6	71·5	18·2	2·80	46·9
,,	...	21·1	1·55	17·1	81·2	18·6	3·20	46·9
,,	...	21·7	1·65	16·8	77·3	18·8	2·45	46·9
5/12/28	...	21·5	1·35	17·2	80·2	17·5	2·85	46·4
7/12/28	...	21·9	1·65	16·5	73·8	18·0	2·45	45·5
10/12/28	...	21·5	1·55	16·2	75·3	17·8	2·60	46·9
12/12/28	...	21·1	1·50	16·4	77·7	17·1	2·25	46·8
,,	...	21·5	1·60	16·0	74·6	17·8	2·40	46·7
18/12/28	...	21·7	1·60	15·9	73·3	18·8	2·75	45·8
19/12/28	...	21·3	1·50	15·4	72·3	18·7	2·10	46·4
22/12/28	...	21·1	1·30	15·1	71·5	18·5	2·40	45·9
24/12/28	...	21·7	1·60	15·2	70·0	18·5	3·05	45·8
31/12/28	...	21·9	1·70	16·3	74·6	18·7	2·40	45·5
3/1/29	...	21·6	1·65	15·5	71·6	18·4	3·00	—
1/11/28	...	22·8	1·50	17·6	77·2	19·0	3·05	44·8
,,	...	22·6	1·60	16·8	74·5	17·4	3·20	45·4
19/11/28	...	22·3	1·45	17·2	77·3	19·3	2·40	46·3
,,	...	22·7	1·40	16·7	73·7	19·4	2·70	47·0
,,	...	22·6	1·45	16·1	71·3	19·0	2·75	45·5
,,	...	22·1	1·45	16·1	75·3	19·0	2·50	45·7
,,	...	22·8	1·65	17·7	77·9	19·4	2·95	45·7

SAORSTÁT EIREANN MID-SEASON FRUIT CROP REPORT, 1930.

The weather conditions during the Winter and early Spring were generally wet, cold and windy. During such dry spells as were experienced, the days were harsh, with white frosts at night. These conditions impeded work in the gardens and orchards, and continuing as they did into early Spring, retarded growth by periods varying from ten to twenty days. In the South-Eastern counties, notably in Waterford, Wexford and Wicklow, fruit trees, particularly plums and pears, suffered considerably from the Spring frosts, hail showers, and cold winds which also injured fruit trees generally in counties Kildare, Limerick and Galway. Soft fruits were unfavourably affected by the harsh dry conditions in May, particularly those in exposed situations. The weather experienced during the greater part of June and July was all that could be desired for the ripening of most of the bush fruits, and these yielded, or gave promise of yielding, very heavy crops. Apples, pears and plums which were in a backward condition owing to the coldness of May, during which period many of the fruits dropped, began to swell rapidly, and promised exceptionally large crops. Taking the season as a whole, the absence of severe frosts during the flowering period enabled most of the trees and bushes to set a large amount of fruit—in many cases rather more than the trees were capable of bearing. and less injury than usual was caused by attacks of insects and fungoid pests.

Bush and Small Fruits.

Gooseberries:—The crop of gooseberries was reported to be one of the heaviest on record, the fruit being of good size and quality. Only three per cent. of the Department's correspondents reported an under-average crop, while a number of them recorded the yield of a double crop. Very heavy crops were reported from Counties Galway, Meath, Dublin, Limerick and Wicklow. The supply in many districts was, therefore, greater than the demand, with the result that prices were lower than in other recent years. In Dublin the price of green fruit opened at 8d. per lb. punnet, but fell to from 2d. to 4d. per lb. according to quality, for twelve pound chips or floats. In County Cork the ruling price was 1s. per gallon; in County Donegal the price was as low as 1s. per stone; in County Limerick the fruit was sold at 14s. per cwt., in County Monaghan, 16s. per cwt., and in County Wicklow, 1s. 9d. per gallon. Fruit marketed in small quantities in the provincial towns made fairly good prices; but where sold in large quantities for jam manufacture the prices realised were considered low.

Strawberries:—Strawberries were in general a very good crop. The fruit was of large size and of excellent quality. Early crops, even though they ripened somewhat later than normally, were lacking in size, but the later fruits, benefiting by the timely rain, swelled up well, and were of very good colour and flavour. The plants did not commence growth as early as usual,

thus escaping injury by frost, and came away well with a large quantity of good strong flower trusses which set freely. In very many cases the plants yielded an extra heavy crop of good sound clean fruit.

In County Dublin, where large quantities of strawberries are grown for market, the rain came just as the fruits were swelling, and the weather continued very favourable throughout, enabling a large crop of very good fruit to be marketed. Prices, however, were lower than last year, beginning at 2s. 6d. per lb., and dropping to 6d. for small fruits at the end of the season. In County Carlow the price was from 1s. to 2s. per lb., and similar prices ruled in Counties Kilkenny, Sligo and Wexford. In County Mayo, prices were from 6d. to 1s. per lb., and in County Waterford, 9d. to 1s. 6d. per lb.

Raspberries:—A bumper crop of Raspberries was obtained all over the country, practically all growers reporting either a good or a very good yield. The quality of the fruit was also reported to have been excellent. The weather was favourable at the flowering period, and rain came at an opportune time to mature the fruit. This crop is not cultivated for marketing to any considerable extent except in Counties Louth, Meath and Dublin. Growers in most of the other Counties merely sell any surplus left over after their own requirements have been met. The large growers forward their crop to the Dublin Market for sale by public auction and most of it eventually goes for jam manufacture. Fairly satisfactory prices were realised in Dublin for sound fruit in good condition but the prices paid by jam factories were not considered satisfactory. In County Cork raspberries sold at from 8d. per lb., to as low as 3s. 6d. to 4s. 6d. per stone. In Dublin the prices were from 6d. to 9d. per lb. punnet, and in bulk for jam making at 2¾d. per lb. In County Louth the price was 5s. per stone, and in County Sligo 5d. per lb.

Loganberries:—This fruit yielded a very large crop, all correspondents reporting good yields. The plants flowered freely, and the showery weather in July enabled the fruit to swell to a very large size. The berries matured well, and were of very good flavour; indeed, the crop was one of the most satisfactory yet recorded. Particularly heavy yields were reported from Counties Donegal, Dublin, Meath, Tipperary, Cork and Waterford. Prices were lower than usual, viz., Dublin, 6d. to 9d. per lb., and Limerick, 10d. per lb. A satisfactory feature of the reports is the increasing number of enquiries both by new and existing growers for plants to extend the production of this fruit.

Red and White Currants:—These fruits gave high yields in every district and the berries were of large size and of very good quality. The market demand this year was slightly better than was experienced last year. It is gratifying to find that growers are taking more pains than formerly to protect the trees and fruit from the attacks of bullfinches in the Spring, and from blackbirds and thrushes in the Summer, when the fruit is on the trees. Extra heavy crops were reported from Counties Clare, Cork, Kerry,

Kildare, Offaly and Wicklow. The caterpillars of the sawfly were not so troublesome as in past years.

The prices realised for these fruits were:—in County Carlow, 5d. per lb., in County Cork, 3s. 6d. per stone, and in Dublin Wholesale Market, 2½d. to 5d. per lb.

Black Currants:—This year has been remarkable for the extraordinary crops of this fruit. Only one per cent. of the correspondents reported a below-average yield, while sixty per cent. reported a very heavy yield. In Counties Sligo, Louth and Roscommon, crops in exposed situations suffered from wind. In dry situations, and on very light soils, there was a little premature dropping of fruit, and the remaining fruits were smaller in size than usual. On low-lying and moist soils heavy crops of fruit of very high quality were obtained. The varieties Boskoop Giant and Victoria yielded the heaviest returns, particularly in Counties Cork, Galway, Kilkenny, Westmeath and Waterford. Where the fruit was sold in small quantities in provincial towns, fair prices were obtained, but prices for fruit sold in bulk for jam making were lower.

Prices ruled as follows:—In County Carlow 8d. per lb., Dublin from 5d. to 8d. per lb., Cork 6d. to 9d., Kilkenny 3d. to 6d., Leix 6d. to 8d., and Waterford 5d. to 8d. In County Sligo prices offered for jam making were 25s. to 28s. per cwt., growers to pay carriage.

Apples:—Apples promised to be one of the best crops on record—certainly the best for the last ten years. Owing to the cold late Spring, the trees did not come into blossom until from ten to fifteen days later than usual, and except in a few isolated areas no injury was done by frost or cold winds. In many cases the crop which set was so heavy that it had to be thinned. The apples developed well, and promised to be of very good size and quality, and were comparatively free from fungoid pests. It is noteworthy that the crop was not nearly so heavy or of as good quality where spraying of the trees had been neglected. Very heavy crops were reported from Clare, where both early and late varieties were promising. In County Cork all varieties cropped well, Bramley's Seedling, Lane's Prince Albert, Worcester Pearmain, and Allington Pippin being exceptionally good. In County Galway the yield promised to be the best for years as almost every variety carried a heavy crop. In County Kildare, Allington Pippin and Newton Wonder did not bear so well as usual. In Counties Meath and Offaly the drought in June caused many of the fruits to drop, but a heavy crop remained. In Counties Kerry, Limerick and Wicklow the early varieties, especially the early desserts, did not crop as heavily as the later kinds. In County Dublin most varieties carried a heavy crop, especially Cox's Orange Pippin and The Queen. In County Tipperary the crop promised to be one of the most suitable for market grown in recent years, the fruit being of good and uniform size. In County Waterford a heavy yield was reported, especially in Bramley's Seedling, Early Victoria, Grenadier, Beauty of Bath, Allington Pippin, and King of

the Pippins. In Leix most varieties cropped well, Allington Pippin and Newton Wonder being the exceptions. Many trees which yielded light crops last year had to be thinned this year.

Pears:—Reports generally indicated a very much larger yield of fruit than usual. Comparatively little injury was done by insect and fungoid pests. Almost everywhere the trees on walls were heavily laden, though in some districts, especially in Counties Kildare, Westmeath and Wicklow, while the trees flowered and set well, many of the fruits dropped during the dry period in late May and early June. In County Dublin trees in exposed situations gave only medium yields. In County Clare very large crops of good quality fruit were obtained. In Donegal the crop was exceptionally good, especially on trees grown against walls. In Counties Cork, Limerick, Galway and Mayo the yield was also very good, especially in the varieties Doyenne du Comice, William's Bon Chretien, and Pitmaston Duchess. In Leix and Offaly the crop was poor, except in the case of trees grown against walls or in sheltered situations. In County Waterford the varieties William's Bon Chretien, Doyenne du Comice, and Pitmaston Duchess were good on the walls, but trees in the open did not bear so well. In County Tipperary the crops in general were good, especially the varieties Pitmaston Duchess, Fertility, Beurre Hardy, William's Bon Chretien, and Durondeau.

Plums:—Plums yielded good crops in the majority of gardens and plantations. About fifteen per cent. reported below-average yields, due to the exposed position of the trees, which suffered from frost and hail-storms during the flowering period. In a number of plantations in Counties Meath, Dublin and Kildare, the crop was so heavy that the branches had to be supported. The varieties which gave the highest yields were Violets, Czar and Victoria. Victoria proved the outstanding variety of the year, yielding in almost all cases overladen crops. In many cases thinning had to be adopted in order to ensure that the fruit would be of commercial size. In County Longford the varieties yielding best were Victoria and Early Rivers and in County Waterford, Victoria, Czar, Jefferson and Denniston's Superb gave very heavy crops.

Damsons:—Damsons were good in general, the weather conditions at the time of flowering having been greatly in their favour. Except, however, in Counties Cavan, Dublin, Louth, Donegal, Meath, Kildare and South Monaghan, this fruit is not grown on a large scale. From the counties mentioned the crop was reported to be good or very good. In County Meath, however, the crop although generally good was somewhat variable, some plantations giving extra heavy yields whilst others were below the average. Nevertheless in almost all cases the crops were much better than last year.

Cherries:—In general, cherries yielded an above-average crop. The trees flowered extra well, but in Counties Cork, Longford and Galway they suffered from hail storms and cold winds. In the cherry growing districts of County Donegal the crop yields were somewhat variable. In County Dublin

sweet cherries, such as May Duke and White Heart, promised well, but owing to the dry weather before ripening much of the fruit dropped. In County Wicklow the crop was good but late in ripening, and the fruit was rather smaller than usual owing to lack of sunshine. Morell, a cooking cherry, usually grown on walls, was a good crop almost everywhere. In County Donegal the fruit sold at 8d. per lb., in Counties Meath and Dublin at 6d. to 8d. per lb.

Many growers have ceased to take much interest in the culture of these fruits owing to the difficulty of protecting the fruit against the ravages of blackbirds, rooks and starlings.

Other Fruits:—Peaches and Figs did exceptionally well this year. The fruits were of large size and of good appearance, especially in Counties Cork, Tipperary, Wicklow, Kilkenny and Wexford. Walnuts and Filberts cropped heavily and promised higher yields than have been obtained for some years.

Insects.

Growers are annually realising more and more the importance of using suitable spray fluids to counteract the ravages of insect pests on the different kinds of fruit trees. They have learned that it is only by timely and proper spraying that loss from attacks of insect pests can be warded off. Many growers report that little trouble was experienced this year from insect pests in the case of trees and bushes that had been properly sprayed. Generally speaking, however, insects were not so troublesome as in other years. Green-fly or Aphis was one of the worst offenders, especially during the months of May and June when the weather was dry and harsh. The activities of this insect were much checked by the showery weather which prevailed in the succeeding months, and only a little spraying was found to be necessary. Aphis did much damage to black currants in counties Mayo and Wicklow, to gooseberries in counties Westmeath, Sligo and Galway, and to apples in counties Sligo, Wicklow, Wexford and Cavan. Leaf-curling Aphis injured plums in counties Dublin, Kildare, Roscommon and Meath, and cherries were attacked by black fly in counties Wexford, Tipperary and Kerry. One of the worst pests this year was the gooseberry sawfly. Where timely spraying was not carried out the caterpillars did much damage to gooseberry bushes and the loss to the growers who neglected to spray must have been considerable.

Other leaf-eating insects do not appear to have done much serious damage. Some damage by caterpillars of the ermine, winter and tortrix moths was reported from Counties Louth, Galway, Kilkenny, Dublin, Limerick and Wicklow. American blight, or woolly aphis, was reported to have caused damage to apple trees, especially in old orchards in counties Meath, Dublin, Tipperary, Clare, Offaly and Westmeath. Red Spider was prevalent on

gooseberries in counties Wicklow and Louth, and Capsid bugs were reported as present in counties Sligo and Kildare. Wasps were destructive in counties Dublin and Longford.

FUNGI.

Persistent spraying on the part of the growers greatly reduced the damage caused by fungoid pests; and trees, bushes and fruit presented a much healthier appearace. The most troublesome pest this year was gooseberry cluster cup, or coral spot, which greatly injured both fruit and leaves, especially in gardens and plantations where the trees were not well cared. Black spot or scab on apples and pears was not so evident as in past years. Apple blossom wilt was, however, very prevalent this year and caused apple growers much anxiety. Apple mildew seldom causes much damage, but its presence was reported this year in a County Kildare plantation, and also in County Louth. Silver Leaf on plum was reported from Counties Kilkenny, Westmeath and Waterford, and on apple from County Galway.

IRISH FREE STATE EGG-LAYING COMPETITION, 1928-29.

The Seventeenth Egg-Laying Competition, conducted by the Department of Agriculture, was held at the Munster Institute, Cork, during a period of 48 weeks beginning on 16th October, 1928, and ending on 16th September, 1929. The entries for the Competition were considerably in excess of the accommodation available. A total of 90 pens of pullets of various breeds was accepted, as well as 9 pens of ducks. The number of birds in a pen was six in the case of pullets and four in the case of ducks.

The system introduced in the 1926-27 Competition was continued, whereby entry in two sections (one each for sitting and non-sitting breeds) was reserved for persons holding Egg Distribution Stations under County Committees of Agriculture under the terms of the Department's Scheme (No. 11). Moreover, in order further to encourage the station-holders to keep the best possible stock they were again allowed the privilege of competing in one of the open sections with the same pens as were entered by them in the sections reserved for station-holders.

The Competition for pullets (allowing for the entry in two sections of station-holders' pens) was arranged in Sections as follows:—

Section I.—White Leghorn	21 pens
Section II.—White Wyandotte . . .	34 ,,
Section IV.—Any sitting breed other than White Wyandotte . . .	34 ,,
Section V.—Any non-sitting breed (confined to holders of Egg Distribution Stations—hen and duck—in the Irish Free State in 1928)	12 ,,
Section VI.—Any sitting breed (confined to holders of Egg Distribution Stations—hen and duck—in the Irish Free State in 1928)	33 ,,

Owing to insufficient entries it was found necessary to eliminate Section III. (Any non-sitting breed, other than White Leghorn).

Quality of Birds.

With the object of raising the standard of body size of birds entering for the competition, a new clause was introduced in the regulations making it conditional that pullets should be of the following minimum weights on arrival at the Munster Institute:—

All non-sitting breeds	not	less	than	3½	lb.
White Wyandotte	,,	,,	,,	4½	,,
Rhode Island Red	,,	,,	,,	4½	,,
Plymouth Rock	,,	,,	,,	5	,,
Sussex	,,	,,	,,	5½	,,

In view of the fact that this was the first time the clause was in operation and that in many cases it was only one or two of the birds in a pen that did not conform to the standard of body weight, the Department did not insist upon rigid adherence to the minimum weights prescribed. It must be clearly understood, however, that in future the clause will be enforced, and intending competitors should ensure that all birds entered for the competition are up to the required standard.

While the majority of the birds arrived in good condition, it was again found that in many of the pens the birds were uneven, and in other cases they were immature and of a lower standard of quality than that essential for an egg-laying contest. Over 25 per cent. of the pullets were found to be below the specified standard governing body weight.

Egg Production.

An improvement in the average egg yield has been made, notwithstanding the fact that three pullets (two White Leghorn and one Rhode Island Red) did not lay during the test.

Making no allowance for deaths during the test the average number of eggs per pullet was 188.6 The average number of eggs per pullet for which a record for the full 48 week period was available was 197.5.

The Twenty Per Cent. Clause.

The clause introduced in 1926-27 prescribing a limit of 20 per cent. for second grade eggs was retained, and the improvement in the size of egg was still more marked. The total number of pens disqualified under this Clause was 24; while in the previous test the number so disqualified was 38. Had the original clause, which was in operation up to 1927-28 and which prescribed a limit of 300 second grade eggs, remained in force, the number of pens disqualified would be 16. The reduction in the proportion of second grade eggs was not confined to any one breed as will be seen from Table I., on which is given the percentage of pens of the respective breeds which were disqualified in this competition, and in the previous one, for producing more than 20 per cent. of second grade eggs.

Mortality.

A total of 54 birds died during the competition, representing 10 per cent. as compared with 7.6 per cent in the previous test. Full details will be found on Table VII.

Duck Section.

In the Duck Section nine pens competed, four of Khaki Campbell and five of Indian Runner. It is encouraging to note a general improvement among the ducks from the point of view of stamina, size of egg and production. While some very good individual scores were recorded, the performances of others were disappointing due, no doubt, to the fact that some of the birds were in poor condition on arrival. Two pens (Khaki Campbell) were disqualified under Clause 14 for producing more than 15 per cent. of second grade eggs as compared with six pens (four of Khaki Campbell and two of Indian Runner) in the previous test.

Feeding. The mash fed was similar to that used in the previous test, with the exception that, during the Winter months when green food was not so plentiful, one part by weight of bran was substituted by the same quantity of Alfalfa meal. The grain ration mainly consisted of equal parts by weight of oats, wheat, and cracked maize. The following quantities of foods were used:—

Pullets.		Ducks.	
Mixed Meals ...	39,230 lbs.	Mixed Meals ...	4,232 lbs.
Cracked Maize ...	9,123 ,,	Oats	612 ,,
Oats	4,400 ,,	Wheat	414 ,,
Wheat	2,996 ,,		

Grit, shell, and vegetables fed in addition.

Table I.

Percentage number of pens of each breed disqualified under Clause 26 (more than 20 per cent. second grade eggs) during 1927-28 and 1928-29 tests, respectively.

Breed.	Percentage of Pens Disqualified.	
	1927-28.	1928-29.
	Per cent.	Per cent.
White Leghorn	38·8	19·0
White Wyandotte	54·8	35·3
Rhode Island Red	40·9	25·0
Buff Rock	—	—
Barred Rock	*	50·0
Light Sussex	50·0	33·3
Black Minorca	—	—
Australorp	100·0	—
Black Leghorn	—	*
Black La Bresse	100·0	*
Average ...	44·7	26·6

*Breed not competing.

While the number of pens shown as disqualified in above table is still high, it is encouraging to note from Table II. that over 36 per cent. of the total number of pullets which completed the test laid 200 first grade eggs or more; thus showing that high egg yield can be combined with size of egg.

Table II.

Number and Percentage of Pullets of each Breed which laid 200 First Grade Eggs and over.

Breed.		Total Number of Pullets.	Number of Pullets which laid 200 First Grade Eggs and over.	Percentage of Pullets laying 200 First Grade Eggs and over.
				Per cent.
White Leghorn	...	114	55	48·2
White Wyandotte	...	180	73	40·5
Rhode Island Red	...	137	38	27·7
Buff Rock	...	18	3	16·7
Barred Rock	...	10	2	20·0
Light Sussex	...	16	4	25·0
Black Minorca	...	5	1	20·0
Australorp	...	6	1	16·7
		486	177	36·4

Table III.

The following Table shows the number of pullets competing, the number of eggs laid, cost of food, return for eggs and gross profit for each of the seventeen competitions held since 1912/13:—

Eleven months ending	No. of Pullets	No. of Eggs Laid	Average Number per Bird	Average Value per Bird		Cost of Food per Bird		Average Price of Eggs per doz.	Return per Bird over Cost of Food	
				s.	d.	s.	d.	d.	s.	d.
31st Aug. 1913	318	38,199	120·1	11	2·8	5	8	13·05	5	6·8
„ 1914	282	39,216	139·0	13	3·6	5	8·3	13·77	7	7·3
„ 1915	264	39,764	150·6	17	6	7	0·5	16·75	10	5·5
„ 1916	294	49,830	169·5	23	0·5	8	11·8	19·58	14	0·7
„ 1917	210	36,660	174·6	32	7·2	13	10·7	26·89	18	8·5
„ 1918	210	36,106	171·9	47	4	16	6	39·66	30	10·1
„ 1919	306	55,124	180·0	53	3·4	20	0	42·59	33	3·4
„ 1920	354	65,840	185·98	53	9	19	3·9	41·62	34	5·2
„ 1921	288	51,584	179·0	40	9·5	18	7·3	32·79	22	2·2
9th Sept., 1922	342	63,518	185·72	33	8·8	11	10	26·15	21	10
16th „ 1923	198	38,519	194·5	27	11·5	12	1	20·75	15	10·5
15th „ 1924	342	61,144	178·78	26	6·5	11	1·5	21·37	15	5
15th „ 1925	348	63,755	183·2	27	4·9	10	5·2	22·58	16	11·7
15th „ 1926	342	65,137	190·4	28	6·1	10	7·8	21·5	17	10·3
16th „ 1927	492	93,912	190·88	26	10·7	9	3·6	20·3	17	7·1
16th „ 1928	510	95,226	186·7	24	10·9	10	8	19·2	14	2·9
16th „ 1929	540	101,820	188·6	28	8·5	11	0·5	21·9	17	8

It should be noted that the figures given in the above table are based on the total number of pullets competing, no allowance having been made in respect of deaths during the test.

On Tables IV. and V. pullets which died during the competition have been eliminated from the calculations and true averages for the remaining birds are given.

TABLE IV.

Average Egg Yield from each Breed.

BREED.	Number of Pullets.	Number of Eggs Laid.	Average Number of Eggs Per Pullet.	Average Number of First Grade Eggs Per Pullet.	Average Number of Second Grade Eggs Per Pullet.
White Wyandotte ...	180	36,852	204·7	167·7	37·0
Rhode Island Red ...	137	26,700	194·9	164·3	30·6
White Leghorn ...	114	22,615	198·4	175·7	22·7
Buff Rock ...	18	3,072	170·7	159·2	11·5
Light Sussex ...	16	2,971	185·7	155 3	30·4
Barred Rock ...	10	1,968	196·8	118·6	78·2
Australorp ...	6	980	163·3	142·7	20·6
Black Minorca ...	5	831	166·2	161·0	5·2
	486	95,989	197·5	166·5	31·0

TABLE V.

Average number of First Grade Eggs Per Pullet, during period 16th October to 15th January.

BREED.	Number of Pullets.	Total Number of First Grade Eggs.	Average Number of First Grade Eggs Per Pullet.
White Wyandotte ...	201	8,280	41·2
Rhode Island Red ...	143	5,535	38·7
White Leghorn ...	124	4,367	35·2
Buff Rock	23	782	34·0
Light Sussex	17	605	35·6
Barred Rock	12	327	27·2
Black Minorca ...	6	224	37·3
Australorp	6	38	6·3
	532	20,158	37·9

DUCK SECTION.

Table VI.

Average Return from each Breed.

Breed.	Number of Ducks.	Number of Eggs Laid.	Average Number of Eggs Per Duck.	Average Number of First Grade Eggs Per Duck.	Average Number of Second Grade Eggs Per Duck.
Indian Runner ...	19	3,978	209·3	192·8	16·5
Khaki Campbell ...	16	3,685	230·3	185·1	45·2
	35	7,663	218·9	190·2	28·7

Table VII.

The following Table gives the number of pullets that died during the Test, and the Cause of death in each case :—

Date of Death.	Number of Pullet.	Number of Pen.	Breed.	Cause of Death.
1928.				
Dec. 2	427	72	White Wyandotte	Acute peritonitis and inflammation of the cloaca and oviduct.
,, 2	423	71	White Wyandotte	Advanced stage of tuberculosis.
,, 26	63	11	White Leghorn ...	Ulcerative inflammation of intestines.
,, 28	56	10	White Leghorn ...	Acute peritonitis and inflammation of oviduct following upon rupture of egg in latter tube.
1929.				
Jan. 5	616	106	Rhode Island Red	Acute peritonitis following upon inflammation of the cloaca.
,, 7	258	43	Light Sussex ...	Rupture of the cloaca by an egg during egg-laying.
,, 14	166	28	White Wyandotte	Heart failure, due to ovarian trouble.
,, 15	535	90	Buff Rock ...	Haemorrhage from lungs and liver. In the liver there were found fatty changes which render the organ liable to rupture.
,, 19	333	56	White Leghorn ...	Leukaemia, a disease of the blood.
Feb. 15	198	33	Rhode Island Red	There was no change in any of the organs to account for death.
,, 16	418	70	White Wyandotte	Obstruction of the duodenum with a tangle of rough grass.
,, 21	281	47	White Leghorn ...	Chronic inflammation of the bowels.
Mar. 2	347	58	Black Minorca ...	Inflammation of the intestines.
,, 7	421	71	White Wyandotte	Advanced tuberculosis
,, 10	308	52	White Leghorn ...	Extensively affected with tuberculosis
,, 26	197	33	Rhode Island Red	Advanced tuberculosis.
April 3	510	85	Buff Rock ...	Peritonitis.
,, 5	367	62	White Wyandotte	Acute inflammation of the oviduct which had become everted.
,, 11	483	81	Rhode Island Red	Inpaction of the gizzard with a tangle of rough grass. There was also a considerable amount of haemorrhage into the ovary.
,, 27	606	104	White Wyandotte	Chronic peritonitis and inflammation of the ovary.

TABLE VII.—*continued.*

Date of Death.	Number of Pullet.	Number of Pen.	Breed.	Cause of Death.
May 1	557	93	Barred Rock ...	Tumours on the liver.
,, 5	407	68	White Wyandotte	Peritonitis.
,, 7	539	90	Buff Rock ...	Fatty degeneration of the liver and inflammation of the oviduct.
,, 7	273	46	White Leghorn	Stricture of the intestines.
,, 8	368	62	White Wyandotte	Acute peritonitis
,, 13	65	11	White Leghorn ...	Acute peritonitis following the breaking of an egg in the oviduct, and inflammation of the cloaca.
,, 18	342	57	White Leghorn ...	Visceral gout and haemorrhage into the kidney.
,, 23	107	18	White Wyandotte	Inflammation of the oviduct.
,, 29	449	75	White Wyandotte	Enteritis.
June 1	536	90	Buff Rock ...	Chronic inflammation of the oviduct. In the oviduct there were four large masses of fibrin.
,, 3	73	13	White Wyandotte	The *post-mortem* examination revealed no definite change to account for death. Suffered from digestive trouble a short time previous to death.
,, 5	209	35	Rhode Island Red	Acute peritonitis and inflammation of the oviduct.
,, 10	153	26	White Wyandotte	Oedema of the lungs, and bronchitis.
,, 16	168	28	White Wyandotte	Haemorrhage from the liver, which was in a state of extreme fatty degeneration. Also affected with pulmonary oedema.
,, 29	151	26	White Wyandotte	Advanced tuberculosis.
July 8	130	22	White Wyandotte	Acute peritonitis and inflammation of the oviduct. The latter contained a broken egg.
,, 8	120	20	White Wyandotte	Carcase was very fat, and fatty degenerative changes occurred in the liver. There was no grit in gizzard.
,, 12	313	53	White Leghorn ...	Acute peritonitis and inflammation of the oviduct and cloaca.
,, 16	385	65	White Wyandotte	Acute peritonitis.
,, 18	11	2	White Leghorn ...	Acute peritonitis. There was a broken egg in the peritoneum.
Aug. 2	371	62	White Wyandotte	Advanced cirrhosis of the liver
,, 4	141	24	White Wyandotte	Tuberculosis.
,, 8	58	10	White Leghorn ...	Acute peritonitis following rupture of the oviduct.
,, 10	37	7	White Leghorn ...	Acute peritonitis following the rupture of an egg in the peritoneal cavity.
,, 11	503	84	Rhode Island Red	Acute peritonitis following inflammation of the oviduct in which there was a broken egg.
,, 16	366	61	White Wyandotte	Pneumonia.
,, 19	570	95	Light Sussex ...	Acute peritonitis following septic infection of the ovary.
,, 28	550	92	Barred Rock ...	Leukaemia, a disease of the blood.
,, 28	451	76	White Wyandotte	Pneumonia.
,, 30	465	78	Rhode Island Red	Showed evidence of peritonitis following rupture of egg in oviduct. There was also a pneumonia present.
Sept. 5	540	90	Buff Rock ...	Leukaemia and chronic peritonitis.
,, 10	545	91	Buff Rock ...	Haemorrhage from the bowel.
,, 12	433	73	White Wyandotte	Acute peritonitis and inflammation of the oviduct and cloaca.
,, 15	386	65	White Wyandotte	Acute peritonitis and inflammation of the oviduct.

DUCKS.

Date of Death.	Number of Duck.	Number of Pen.	Breed.	Cause of Death.
1929. Mar. 7	575	97	Indian Runner ...	Inflammation of the oviduct and cloaca.

LIST OF PRIZEWINNERS.

Section I.—White Leghorn.

Name and Address of Owner.	Total Number of Eggs. Laid.	Number of Second Grade Eggs.	Value of Eggs.	Average Number of Eggs. Per Bird.
			£ s. d.	
First Prize. Miss E. Cavanagh, Kimmage Grove, Terenure, Dublin.	1,378	101	10 10 0	229·7
Second Prize. Miss K. F. O'Connor, The Rectory, Newbridge, Co. Kildare.	1,366	108	10 6 7½	227·7
Third Prize. Mr. H. L. Neligan, Kells, Co. Kerry.	1,261	28	9 12 10	210·2
Fourth Prize. Mrs. N. M. McElligott, Bedford, Listowel, Co. Kerry.	1,313	216	9 12 8	218·8

Section II.—White Wyandotte.

Name and Address of Owner.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs	Average Number of Eggs Per Bird.
			£ s. d.	
First Prize. Mrs. Jetty Murphy Newrath, Waterford.	1,473	273	11 5 2¾	245·5
Second Prize. Mrs. M. McDowell, Dunany, Dunleer, Co. Louth.	1,427	94	11 1 8½	237·8
Third Prize. Mrs. N. Chearnley, Glendoneen, Ballinhassig, Co. Cork.	1,381	119	11 0 9¼	230·2
Fourth Prize. Mrs. R. Eadie, The Poplars, Beaufort, Co. Kerry.	1,283	154	10 6 1¼	213·8

(Section III. was eliminated owing to insufficient entries).

SECTION IV.—SITTING BREEDS (other than White Wyandotte).

Name and Address of Owner.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs	Average Number of Eggs Per Bird.
				£ s. d.	
First Prize. Mrs. M. Burton, Mine Hill, Millstreet, Co. Cork.	Rhode Island Red	1,255	45	10 0 10	209·2
Second Prize. Mr. C. F. Harvey, Duffcarrig, Gorey.	,,	1,283	136	9 18 1¾	213·8
Third Prize. Mrs. E. Murphy, Johnstown, Rivers-town, Dundalk.	,,	1,224	221	9 7 9¼	204
Fourth Prize. Mrs. M. E. Armstrong, Rosslare, Co. Wexford.	,,	1,243	229	9 6 2	207·2

SECTION V.—NON-SITTING BREEDS (STATION-HOLDERS).

Name and Address of Owner.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs	Average Number of Eggs Per Bird.
				£ s. d.	
First Prize. Miss A. Fitzgerald, Ard oul, Rathkeale, Co. Limerick.	White Leghorn	1,268	151	9 10 5½	211·3
Second Prize. Mrs. C. Mulcahy, Ballinahown, Ardagh, Co. Limerick.	,,	1,225	195	9 1 2	204·2
Third Prize. Mrs. M. E. Higgins, Carramarla Lodge, Claremorris, Co. Mayo.	,,	1,163	35	8 17 11½	193·8
Fourth Prize. Mrs. S. Cormack, Ballykerin, Ballycurry, Thurles.	,,	1,088	41	8 12 0	181·3

Section VI.—Sitting Breeds (Station-holders).

Name and Address of Owner.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs	Average Number of Eggs Per Bird.
				£ s. d.	
First Prize. Mrs. K. Mullen, Oristown, Kells, Co. Meath.	White Wyandotte.	1,288	97	10 0 11¼	214·7
Second Prize. Mrs. M. Burton, Mine Hill, Millstreet, Co. Cork.	Rhode Island Red	1,255	45	10 0 10	209·2
Third Prize. Miss A. Donegan, Monasterboice, Drogheda	White Wyandotte	1,167	9	9 16 6¾	194·5
Fourth Prize. Miss E. O'Donohoe Killeigh, Cahir, Co. Tipperary.	,,	1,213	139	9 13 3½	202·2

SPECIAL PRIZES.

The Cup (or its value £10) for the *Pen* of pullets laying eggs of the highest market value during the Competition, has been awarded to Mrs. Jetty Murphy, Newrath, Waterford, for the pen of White Wyandottes which won first prize in Section II.

The special prize for the *Pen* of pullets (non-sitting breed) laying the highest average of first grade eggs per bird during the period from 16th October to 15th January, inclusive, has been awarded to Miss E. Cavanagh, Kimmage Grove, Terenure, Dublin, for Pen No. 4 (White Leghorn) which produced 304 first grade eggs.

The special prize for the *Pen* of pullets (sitting breed) laying the highest average of first grade eggs per bird during the period 16th October to 15th January, inclusive, has been awarded to Miss A. Donegan, Monasterboice, Drogheda, for Pen No. 65 (White Wyandotte) which produced 411 first grade eggs.

The special prize for the *Individual Bird* (non-sitting breed) laying the highest number of first grade eggs during the Competition has been awarded to Mrs. S. Cormack, Ballykerin, Ballincurry, Thurles, for Pullet No. 341 (White Leghorn) which laid 254 first grade eggs.

The special prize for the *Individual Bird* (sitting breed) laying the highest number of first grade eggs during the Competition has been awarded to Miss C. Sweeney, Cloonroan House, Castlerea, Co. Roscommon, for Pullet No. 420 (White Wyandotte) which laid 279 first grade eggs.

The special prize for the *Individual Bird* (non-sitting breed) laying the highest number of first grade eggs during the period 16th October to 15th January, inclusive, has been awarded to Mrs. S. Cormack, Ballykerin, Ballincurry, Thurles, for Pullet No. 340 (White Leghorn) which laid 68 first grade eggs.

The special prize for the *Individual Bird* (sitting breed) laying the highest number of first grade eggs during the period 16th October to 15th January, inclusive, has been awarded to Mrs. Mary Burton, Mine Hill, Millstreet, Co. Cork, for Pullet No. 462 (Rhode Island Red) which laid 84 first grade eggs.

DUCK SECTION.

Name and Address of Owner.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs	Average Number of Eggs Per Bird.
				£ s. d.	
First Prize. Mrs. K. Healy, Clonmeen, Banteer, Co. Cork.	Khaki Campbell	1,002	128	6 5 10	250·5
Second Prize. Mrs. A. McGrath, Bamford, Kilkenny.	Indian Runner	991	109	6 3 7¼	247·7
Third Prize. Mrs. E. M. Percival, Temple House, Ballymote, Co. Sligo.	Khaki Campbell	970	83	5 16 1½	242·5

The Special Prize of a silver medal (or its value £2) has been awarded to Mrs. E. M. Percival, Temple House, Ballymote, County Sligo, for Khaki Campbell Duck No. 597 which laid 301 eggs value £1 17s. 10d.

CERTIFICATES AWARDED.

Section I.—White Leghorn.

Special Certificates.

Miss M. E. Cavanagh, Kimmage Grove, Terenure, Dublin. (Pen 4—1,378 Eggs).

Miss K. F. O'Connor, The Rectory, Celbridge, Co. Kildare. (Pen 8—1,366 Eggs).

First Class Certificates.

Mrs. N. M. McElligott, Bedford, Listowel, Co. Kerry. (Pen 5—1,313 Eggs).

Mr. H. L. Neligan, Kells, Co. Kerry. (Pen 6—1,261 Eggs).

Second Class Certificates.

Mr. F. C. Bernard, Belfield, Stillorgan Road, Donnybrook, Dublin. (Pen 3—1,085 Eggs).

Mrs. M. G. King, Beechgrove, Donadea, Co. Kildare. (Pen 7—1,067 Eggs).

Section II.—White Wyandotte.

Special Certificates.

Mrs. J. Murphy, Newrath, Waterford. (Pen 27—1,473 Eggs).
Miss M. C. McDowell, Dunany, Dunleer, Co. Louth. (Pen 19—1,427 Eggs).
Mrs. N. Chearnley, Glendoneen, Ballinhassig, Co. Cork. (Pen 14—1,381 Eggs).

First Class Certificates.

Mrs. R. B. Eadie, The Poplars, Beaufort, Co. Kerry. (Pen 16—1,283 Eggs).
Miss Pearl White, Gortnafluir P.F., Clonmel. (Pen 25—1,254 Eggs).
Mrs. B. Deegan, Lodge Park, Freshford, Co. Kilkenny. (Pen 18—1,252 Eggs).
Mrs. M. L. Barker, The Rectory, Celbridge, Co. Kildare. (Pen 17—1,233 Eggs).
Mrs. M. Drohan, Ballynevin, Carrick-on-Suir. (Pen 26—1,231 Eggs).
Mr. D. V. O'Grady, Minaville, Glanmire, Co. Cork. (Pen 13—1,219 Eggs).

Second Class Certificates.

Mr. R. N. Tweedy, Hinchoge P.F., Carrickmines, Co. Dublin. (Pen 15—1,173 Eggs).
Miss P. Brady, Newtowngirley, Kells, Co. Meath. (Pen 22—1,169 Eggs).
Miss M. Green, Hill House, Lecarrow, Co. Roscommon. (Pen 104—1,126 Eggs).
Mrs. M. Strong, Moate House, Kells, Co. Meath. (Pen 20—1,083 Eggs).

(Section III. was eliminated owing to insufficient entries).

Section IV.—Any Sitting Breed other than White Wyandotte.

First Class Certificates.

Mr. C. F. Harvey, Duffcarrig, Gorey, Co. Wexford. (Pen 109, Rhode Island Red—1,283 Eggs).
Miss G. F. Reeves, Athgarvan House, Newbridge, Co. Kildare. (Pen 34, Rhode Island Red—1,276 Eggs).
Mrs. M. E. Armstrong, Rosslare, Co. Wexford. (Pen 42, Rhode Island Red—1,243 Eggs).

Second Class Certificates.

Mrs. E. M. Dennehy, Ballymanus, Stradbally, Laoighis. (Pen 37, Rhode Island Red—1,190 Eggs).
Miss D. Strong, Moate House, Kells, Co. Meath. (Pen 39, Rhode Island Red—1,160 Eggs).
Mrs. M. Campion, Narraghmore Rectory, Ballytore, Co. Kildare. (Pen 43, Light Sussex—1,147 Eggs).
Miss M. Murray, Racecourse, Clones, Co. Monaghan. (Pen 40, Rhode Island Red—1,143 Eggs).

Mrs. D. Chearnley Salterbridge, Cappoquin, Co. Waterford. (Pen 48, Rhode Island Red—1,133 Eggs).
Mrs. C. O'Shea, Codrum, Macroom, Co. Cork. (Pen 31, Rhode Island Red —1,127 Eggs).
Mr. D. V. O'Grady, Minaville, Glanmire, Co. Cork. (Pen 30, Rhode Island Red—1,095 Eggs).
Mrs. M. G. King, Beechgrove, Donadea, Co. Kildare. (Pen 106, Rhode Island Red—1,068 Eggs).

Section V.—Any Non-Sitting Breed (Station-holders).

First Class Certificates.

Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick. (Pen 50, White Leghorn—1,268 Eggs).
Mrs. C. Mulcahy, Ballinahown, Ardagh, Co. Limerick. (Pen 49, White Leghorn—1,225 Eggs).

Second Class Certificates.

Mrs. M. E. Higgins, Carramarla Lodge, Claremorris, Co. Mayo. (Pen 51, White Leghorn—1,163 Eggs).
Mrs. M. McFadden, Towney, Kilcar, Co. Donegal. (Pen 46, White Leghorn—1,116 Eggs).
Mrs. S. Cormack, Ballykerin, Ballincurry, Thurles. (Pen 57, White Leghorn—1,088 Eggs).
Miss K. Martin, The Mountain, St. John's, Knockcroghery, Co. Roscommon. (Pen 53, White Leghorn—1,048 Eggs).
Mrs. M. Cryan, Seefin, Cloonloo, Boyle, Co. Roscommon. (Pen 54, White Leghorn—1,047 Eggs).
Miss M. E. Anglim, Farranaleen, Fethard, Co. Tipperary. (Pen 56, White Leghorn—1,029 Eggs).

Section VI.—Any Sitting Breed (Station-holders).

First Class Certificates.

Mrs. K. Mullen, Oristown, Kells, Co. Meath. (Pen 67, White Wyandotte—1,288 Eggs).
Mrs. M. Burton, Mine Hill, Millstreet, Co. Cork. (Pen 77, Rhode Island Red—1,255 Eggs).
Mrs. E. Murphy, Johnstown, Riverstown, Dundalk. (Pen 83, Rhode Island Red—1,224 Eggs).
Miss E. O'Donohue, Killeigh, Cahir, Co. Tipperary. (Pen 75, White Wyandotte—1,213 Eggs).
Miss H. Frewen, Rossboy, Glen of Aherlow, Co. Tipperary. (Pen 74, White Wyandotte, 1,211 Eggs).

Second Class Certificates.

Miss C. Mealiff, Ballinamona House, Tullamore. (Pen 84, Rhode Island Red—1,184 Eggs).

Miss A. Donegan, Monasterboice, Drogheda. (Pen 65, White Wyandotte—1,167 Eggs).

Miss M. Bennett, Ballysallagh, Kilderry, Co. Kilkenny. (Pen 80, Rhode Island Red—1,164 Eggs).

Mrs. J. M. Walsh, Ballyvoreen House, Murroe, Co. Limerick. (Pen 64, White Wyandotte—1,153 Eggs).

Mrs. A. L. Hurley, Cloncorban, Ballineen, Co. Cork. (Pen 78, Rhode Island Red—1,150 Eggs).

Mrs. L. Mounsey, Beech Hill, Ballyduff, Tullamore. (Pen 89, Buff Rock—1,143 Eggs).

Miss C. Sweeney, Cloonroan House, Castlerea, Co. Roscommon. (Pen 70, White Wyandotte—1,117 Eggs).

Mrs. M. French, Poulfaille Cottage, New Ross. (Pen 91, Buff Rock—1,059 Eggs).

Mrs. E. A. Henderson, Ardrum, Inniscarra, Co. Cork. (Pen 93, Barred Rock—1,042 Eggs).

Mrs. M. Nagle, Springmount, Mallow, Co. Cork. (Pen 59, White Wyandotte—1,041 Eggs).

Mrs. A. B. Barber, Knockbeg House, Collooney, Co. Sligo. (Pen 73, White Wyandotte—1,023 Eggs).

DUCK SECTION.

First Class Certificates.

Mrs. K. Healy, Clonmeen, Banteer, Co. Cork. Pen 100, Khaki Campbell—1,002 Eggs).

Mrs. A. McGrath, Bamford, Kilkenny. (Pen 99, Indian Runner—991 Eggs).

Mrs. E. M. Percival, Temple House, Ballymote, Co. Sligo. (Pen 102, Khaki Campbell—970 Eggs).

Mrs. M. Cruite, Tulla, Three Castles, Co. Kilkenny. (Pen 98, Indian Runner—928 Eggs).

Mrs. R. Verling, Kill, St. Anne, Castlelyons, Fermoy. (Pen 97, Indian Runner, 847 Eggs).

Second Class Certificates.

Mrs. M. F. Shiel-Walsh, Moneyvroe, Cappoquin, Co. Waterford. (Pen 108, Indian Runner—708 Eggs).

Pullets which Qualified for Copper Rings.

The following Table gives particulars of the 177 pullets which laid 200 first grade eggs or over, and not more than 20 per cent. second grade.

Table VIII.

White Leghorn (55 Pullets).

Number of Pen.	Number of Pullet.	Eggs Laid: First Grade.	Eggs Laid: Second Grade.	Total	Number of Sealed Ring.	Owner.
4	20	216	3	219	1	Miss E. Cavanagh, Kimage Grove, Terenure, Dublin.
	21	229	4	233	2	
	22	207	2	209	3	
	23	214	5	219	4	
	24	221	8	229	5	
8	45	251	6	257	6	Miss K. F. O'Connor, The Rectory, Newbridge, Co. Kildare.
	46	201	3	204	7	
	47	236	13	249	8	
	48	229	22	251	9	
6	31	228	—	228	10	Mr. N. L. Neligan, Kells, Co. Kerry.
	33	216	15	231	11	
	34	230	1	231	12	
	35	201	—	201	13	
	36	242	4	246	14	
5	25	210	27	237	15	Mrs. N. McElligott, Bedford, Listowel, Co. Kerry.
	26	219	11	230	16	
	29	220	—	220	17	
	30	232	3	235	18	
50	295	239	7	246	19	Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.
	298	223	15	238	20	
55	325	221	10	231	21	Mrs. B. O'Brien, Philipstown Cottage, Cappawhite, Co Tipperary.
	326	205	2	207	22	
2	7	219	10	229	23	Mrs. M. Rankin, Ballyhaskey, Newtowncunningham, Co. Donegal.
	8	212	7	219	24	
	10	219	3	222	25	
	12	211	6	217	26	
49	289	202	27	229	27	Mrs. C. Mulcahy, Ballinahown, Ardagh, Co. Limerick.
	292	239	8	247	28	
	293	220	4	224	29	
51	301	250	—	250	30	Mrs. M. E. Higgins, Carramarla Lodge, Claremorris, Co. Mayo.
	304	224	1	225	31	
	305	211	1	212	32	

Number of Pen.	Number of Pullet.	Eggs Laid		Total	Number of Sealed Ring.	Owner.
		First Grade.	Second Grade.			
57	338 340 341	244 207 254	— — 8	244 207 262	33 34 35	Mrs. S. Cormack, Ballykerin, Ballincurry, Thurles, Co. Tipperary.
46	271 274 276	201 217 240	13 — —	214 217 240	36 37 38	Mrs. M. McFadden, Towney, Kilcar, Co. Donegal.
7	38 41 42	212 248 236	27 3 10	239 251 246	39 40 41	Mrs. M. G. King, Beech Grove, Donadea, Co. Kildare.
3	13 14 16 17	210 208 201 247	37 — — 4	247 208 201 251	42 43 44 45	Mr. F. C. Bernard, Belfield, Stillorgan Road, Ballsbridge, Dublin.
56	331 334 336	218 216 243	7 2 1	225 218 244	46 47 48	Miss M. E. Anglim, Farranaleen, Fethard, Co. Tipperary.
53	314	245	2	247	49	Miss K. Martin, The Mountain, St. John's, Knockcroghery, Co. Roscommon.
54	321 323 324	211 207 205	2 16 —	213 223 205	50 51 52	Mrs. M. Cryan, Seefin, Cloonloo, Boyle, Co. Roscommon.
47	277 282	213 229	30 —	243 229	53 54	Mrs. M. McMahon, Gaybrook, Malahide, Co. Dublin.
10	57	232	4	236	55	Mrs. G. Galway-Greer, Rooske Lodge, Dunboyne, Co. Meath.

White Wyandotte (73 Pullets).

Number of Pen.	Number of Pullet.	Eggs Laid		Total	Number of Sealed Ring.	Owner.
		First Grade.	Second Grade.			
27	157 159 160 161	251 238 213 278	4 18 3 —	255 256 216 278	57 58 59 60	Mrs. J. Murphy, Newrath, Waterford.

Number of Pen.	Number of Pullet.	Eggs Laid		Total.	Number of Sealed Ring.	Owner.
		First Grade.	Second Grade.			
19	109	234	4	238	61	Mrs. M. McDowell,
	110	230	18	248	62	Dunany, Dunleer
	111	222	10	232	63	Co. Louth.
	112	260	4	264	64	
14	79	251	—	251	65	Mrs. N. Chearnley,
	81	231	19	250	66	Glendoneen, Ballinhassig,
	82	233	17	250	67	Co. Cork.
16	91	232	2	234	68	Mrs. R. Eadie,
	93	217	20	237	69	The Poplars, Beaufort,
	94	208	10	218	70	Co. Kerry.
18	105	200	12	212	71	Mrs. B. Deegan,
	106	237	1	238	72	Lodge Park, Freshford,
	108	262	1	263	73	Co. Kilkenny.
60	355	258	2	260	74	Mrs. J. Lehane,
	356	204	38	242	75	Crossmahon, Lissarda,
	359	214	2	216	76	Co. Cork.
67	398	246	6	252	77	Mrs. K. Mullen,
	399	203	2	205	78	Oristown, Kells,
	402	208	14	222	79	Co. Meath.
65	387	233	1	234	80	Miss A. Donegan,
	388	225	1	226	81	Monasterboice, Drogheda,
	390	222	3	225	82	Co. Louth.
61	361	201	8	209	83	Miss J. O'Keeffe,
	362	242	2	244	84	Ballybooden, Knocktopher,
	365	218	18	236	85	Co. Kilkenny.
17	98	203	22	225	86	Mrs. M. Barker,
	101	200	23	223	87	The Rectory, Celbridge,
	102	214	40	254	88	Co. Kildare.
26	154	204	30	234	89	Mrs. M. Drohan,
	156	262	15	277	90	Ballynevin, Carrick-on-Suir, Co. Waterford.
75	445	241	—	241	91	Miss E. O'Donoghue,
	448	216	5	221	92	Killeigh, Cahir,
	450	212	18	230	93	Co. Tipperary.
25	148	215	33	248	94	Miss P. White,
	149	228	1	229	95	Gortnafluir, Clonmel,
	150	225	4	229	96	Co. Tipperary.
13	74	239	2	241	97	Mr. D. V. O'Grady,
	76	235	—	235	98	Minaville, Glanmire, Co. Cork.

Number of Pen.	Number of Pullet.	Eggs Laid: First Grade.	Eggs Laid: Second Grade.	Total	Number of Sealed Ring.	Owner.
22	127	259	—	259	99	Miss P. Brady,
	128	249	—	249	100	Newtowngirely,
	132	206	3	209	101	Kells, Co. Meath.
74	439	229	1	230	102	Mrs. H. Frewen,
	442	254	—	254	103	Rossboy, Glen of Aherlow,
	443	250	7	257	104	Co. Tipperary.
104	603	244	—	244	105	Miss M. Greene,
	604	224	—	224	106	Hill House, Lecarrow,
	607	212	—	212	107	Co. Roscommon.
15	85	200	11	211	108	Mr. R. N. Tweedy,
	86	203	14	217	109	Hinchogue, Carrickmines,
	87	226	7	233	110	Co. Dublin.
64	379	216	9	225	111	Mrs. J. M. Walsh,
	381	214	6	220	112	Ballyvoreen House,
	382	230	8	238	113	Murroe, Co. Limerick.
20	115	222	11	233	114	Mrs. M. Strong,
	116	204	1	205	115	Moate House, Kells, Co. Meath.
70	417	207	2	209	116	Miss C. Sweeney,
	419	222	—	222	117	Cloonroan House,
	420	279	1	280	118	Castlerea, Co. Roscommon.
76	453	205	3	208	119	Mrs. J. Tomkins, Ballygullen, Craanford, Gorey.
105	609	214	36	250	120	Miss E. Cavanagh,
	612	205	39	244	121	Kimmage Grove, Terenure, Dublin.
29	173	206	—	206	122	Mr. C. F. Harvey, Duffcarrig, Gorey, Co. Wexford.
62	370	233	30	263	123	Mrs. M. Byrne, Knockbutton, Windgap, Co. Kilkenny.
21	126	211	9	220	124	Miss E. M. Harman, Crossdrum, Oldcastle, Co. Meath.
24	143	239	9	248	125	Mrs. L. Ross, Liscarney, Monaghan.

Number of Pen.	Number of Pullet.	Eggs Laid		Total.	Number of Sealed Ring.	Owner.
		First Grade.	Second Grade.			
59	350 353	211 206	— 2	211 208	126 127	Mrs. M. Nagle, Springmount, Mallow, Co. Cork.
71	424 425	235 205	— 3	235 208	128 129	Mrs. J. Spellman, Ardmore, Boyle, Co. Roscommon.

RHODE ISLAND RED (38 PULLETS).

Number of Pen.	Number of Pullet.	First Grade.	Second Grade.	Total.	Number of Sealed Ring.	Owner.
86	511 514 515	215 248 225	3 2 7	218 250 232	130 131 132	Mrs. B. Naughton, Larkfield House, Athlone, Co. Roscommon.
77	457 459 461 462	261 204 233 235	2 7 — 2	263 211 233 237	133 134 135 136	Mrs. M. Burton, Mine Hill, Millstreet, Co. Cork.
109	633 634 637	231 250 241	31 24 3	262 274 244	137 138 139	Mr. C. F. Harvey, Duffcarrig, Gorey, Co. Wexford.
83	494	216	11	227	140	Mrs. E. Murphy, Johnstown, Riverstown, Dundalk.
42	250	204	2	206	141	Mrs. M. E. Armstrong, Rosslare, Co. Wexford.
84	502 503	209 217	— 6	209 223	142 143	Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.
34	201 202 204	242 215 207	9 9 11	251 224 218	144 145 146	Mrs. G. S. Reeves, Athgarvan House, Newbridge, Co. Kildare
48	286 287	222 223	26 —	248 223	147 148	Mrs. D. C. Chearnley, Salterbridge, Cappoquin, Co. Waterford.
78	463 468	247 218	11 4	258 222	149 150	Mrs. A. L. Hurley, Cloncorban, Ballineen, Co. Cork.
39	229 230 234	203 222 216	13 1 14	216 223 230	151 152 153	Miss D. Strong, Moate House, Kells, Co. Meath.

Number of Pen.	Number of Pullet.	Eggs Laid: First Grade.	Eggs Laid: Second Grade.	Total	Number of Sealed Ring.	Owner.
37	217 218	231 218	4 3	235 221	154 155	Mrs. E. M. Dennehy, Ballymanus, Stradbally, Laoighis.
35	205	225	5	230	156	Mrs. J. Deady, Jerpoint Abbey, Thomastown, Co. Kilkenny.
82	487	215	23	238	157	Mrs. K. Sheehy, Bridge House, Ballingarry, Co. Limerick.
40	240	202	1	203	158	Miss M. Murray, Racecourse, Clones, Co. Monaghan.
106	615 617 620	236 209 227	3 16 2	239 225 229	159 160 161	Mrs. M. G. King, Beechgrove, Donadea, Co. Kildare.
31	181 182 186	201 249 214	1 3 —	202 252 214	162 163 164	Mrs. C. O'Shea, Codrum, Macroom, Co. Cork.
81	481	229	1	230	165	Miss E. M. Scanlan, Ballyduhig House, Ballagh, Charleville, Co. Limerick.
33	193	222	14	236	166	Mr. E. A. Poulter, St. Brigid's, Roebuck, Clonskea, Co. Dublin.
80	478	217	4	221	177	Miss M. Bennett, Ballysallagh, Kilderry, Co. Kilkenny.
						BUFF ROCK.
91	541	226	—	226	167	Mrs. M. Ffrench, Poulfaille Cottage, New Ross, Co. Wexford.
89	533	218	2	220	168	Mrs. L. Mounsey, Beech Hill, Ballyduff, Tullamore, Offaly.
85	506	210	2	212	169	Mrs. N. Ryan, Cluggan House, Oola, Co. Limerick.

BARRED ROCK.

Number of Pen.	Number of Pullet.	Eggs Laid		Total.	Number of Sealed Ring.	Owner.
		First Grade.	Second Grade.			
93	555 558	205 237	8 —	213 237	170 171	Mrs. E. A. Henderson, Ardrum, Inniscarra, Co. Cork.

LIGHT SUSSEX.

43	253 254 257	213 263 245	16 6 —	229 269 245	172 173 174	Mrs. M. Campion, Narraghmore Rectory, Ballytore, Co. Kildare.
94	562	243	16	259	175	Miss E. Walsh, Ballylemon Lodge, Cappagh, Co. Waterford.

BLACK MINORCA.

58	348	213	4	217	56	Mrs. R. Cochrane, Tullyroe, Tremaine, Co. Roscommon.

AUSTRALORPS.

44	260	211	1	212	176	Mrs. S. J. Grabbett, Ballaghtobin, Callan, Co. Kilkenny.

SECTION I.—WHITE LEGHORN.

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade	No. of Second Grade	Total.	First Grade Eggs, 16th Oct. 15th Jan.	Value per Pullet	Untrapped Eggs	Total Value of Eggs from Pen	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
																							s. d.		£ s. d.				
1	4	Miss E. Cavanagh, Kimmage Grove Terenure, Dublin.	March	19	3 8	4 4	8	21	23	20	23	28	28	27	27	22	28	13	190	78	268	41	39 3¼	1		(a) 1,378	—	—	July
			April	20	4 8	5 8	6	21	24	24	19	21	24	18	19	17	16	10	216	3	219	62	34 11¾	—		lbs. ozs. dr.	—	—	Aug.
			March	21	3 8	4 0	12	25	20	19	4	28	27	28	23	20	21	6	229	4	233	62	36 4¼	—	10 10 0	(b) 185 6 7	—	—	Sept' & Feb.
			,,	22	3 8	3 8	—	18	22	16	20	21	25	24	25	14	16	8	207	2	209	45	32 0	—		ozs.	—	—	July
			,,	23	3 8	4 8	—	7	22	21	21	27	21	25	23	23	19	10	214	5	219	41	32 6¾	—		(c) 25·8	—	—	Nov. & Aug.
			,,	24	4 4	4 4	8	20	20	9	19	26	29	20	22	24	22	10	221	8	229	53	34 8	—			—	—	—
2	8	Miss K. F. O'Connor, The Rectory, Newbridge, Co. Kildare.	20/3/28	43	3 8	4 8	10	18	22	16	8	20	20	22	22	21	16	12	144	63	207	26	30 8	—		(a) 1,366	—	—	—
			23/2/28	44	3 8	4 8	—	—	10	20	18	21	25	24	22	26	21	11	197	1	198	19	27 9	—		lbs. ozs. dr.	—	—	Nov.
			,,	45	4 8	4 2	8	23	25	20	20	26	26	22	25	30	29	3	251	6	257	64	39 11½	—	10 6 7½	(b) 188 7 8	—	—	Aug.
			20/3/28	46	4 4	4 4	9	21	19	4	21	22	24	24	20	24	16	—	201	3	204	48	31 1¾	—			—	—	Aug. & Sept.
			30/3/28	47	4 0	4 8	10	20	24	23	23	26	19	25	22	23	24	10	236	13	249	57	39 0¼	—		ozs. (c) 26·5	—	—	Aug.
			23/2/28	48	4 0	4 0	9	16	23	22	22	27	28	26	22	20	24	12	229	22	251	51	38 1	—			—	—	Aug.
3	6	Mr. H. L. Neligan, Kells, Co. Kerry.	19/4/28	31	3 0	4 0	7	21	20	21	19	23	24	23	23	22	17	8	228	—	228	58	35 7¼	—		(a) 1,261	—	—	—
			,,	32	3 8	4 0	8	22	21	2	8	21	17	4	12	—	2	7	116	8	124	48	20 10½	—		lbs. ozs. dr.	—	—	—
			,,	33	3 8	3 8	11	7	14	21	19	25	27	29	22	22	24	10	216	15	231	28	33 6¾	—	9 12 10	(b) 181 5 15	—	—	—
			,,	34	3 8	4 12	1	20	19	19	21	23	25	24	25	22	23	9	230	1	231	48	35 4¾	—		ozs.	—	—	Aug.
			,,	35	3 8	4 4	12	3	16	2	19	22	24	24	24	23	22	10	201	—	201	33	28 9	—		(c) 27·6	—	—	Aug.
			,,	36	3 8	4 0	12	21	24	19	20	23	24	25	21	25	21	11	242	4	246	62	38 7¾	—			—	—	—
4	5	Mrs. N. McElligott, Bedford, Listowel, Co. Kerry.	6/4/28	25	3 8	4 2	12	25	22	21	19	21	23	25	22	22	18	7	210	27	237	46	36 10½	—		(a) 1,313	—	—	Aug.
			,,	26	3 8	4 8	13	13	8	21	19	22	27	26	23	24	22	12	219	11	230	34	33 9¼	—		lbs. ozs. dr.	—	—	July
			,,	27	3 8	3 12	—	14	22	20	19	21	25	24	24	23	9	—	198	3	201	43	30 3¾	—	9 12 8	(b) 176 3 6	—	—	Sept.
			,,	28	3 4	3 12	5	11	—	10	7	23	27	28	23	25	20	11	18	172	190	2	21 10¼	—		ozs.	—	—	—
			,,	29	4 0	4 12	9	19	20	8	9	24	28	25	23	24	20	11	220	—	220	55	33 4¼	—		(c) 25·8	—	—	Aug.
			,,	30	3 0	4 0	1	25	21	19	17	21	25	26	26	21	22	11	232	3	235	54	36 6	—			—	—	July
‡5	50	Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	March	295	3 8	4 12	—	21	24	22	22	24	26	26	25	23	25	8	239	7	246	55	37 10½	—		(a) 1,268	—	—	—
			,,	296	3 8	5 0	—	2	17	19	21	25	20	24	23	20	19	9	186	13	199	26	28 6½	—		lbs. ozs. dr.	—	—	—
			,,	297	3 8	5 2	1	18	24	17	21	24	22	24	20	9	2	8	183	7	190	44	29 7	—	9 10 5½	(b) 169 2 11	—	—	June & Sept.
			,,	298	3 8	4 8	8	24	23	5	18	22	24	27	23	27	23	14	223	15	238	50	36 4¼	—		ozs.	—	—	Sept.
			,,	299	3 8	4 4	10	20	18	3	18	23	26	25	27	22	13	—	192	13	205	47	30 5¼	—		(c) 25·6	—	—	July.
			,,	300	3 4	4 8	—	23	18	19	17	19	18	20	18	17	15	6	94	96	190	31	27 8	—			—	—	Sept.

‡ Pen also competing in Section V.

SECTION I.—WHITE LEGHORN—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival	Weight: At Close of Test	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade.	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet	Untrapped Eggs	Total Value of Eggs from Pen	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
					lb. oz.	lb. oz.																	s. d.		£ s. d.				
*	2		March	7	4 0	4 8	—	16	24	23	21	22	26	23	22	23	17	12	219	10	229	47	35 0	2		(a) 1,265	—	—	—
		Mrs. M. Rankin,	,,	8	4 0	4 4	12	7	—	22	20	24	22	28	24	25	24	11	212	7	219	25	31 2	—		lbs. ozs. dr.	—	—	—
		Ballyhasey,	9/4/28	9	4 0	4 12	10	17	23	22	19	24	23	22	4	—	7	9	97	83	180	23	27 1½	—	9 4 11¼	(b) 169 11 5	—	—	July
		Newtown-	March	10	4 0	4 4	11	20	2	9	21	22	26	26	23	26	24	12	219	3	222	31	32 5½	—		ozs.	—	—	—
		cunningham,	,,	11	4 0	—	14	5	24	23	21	26	25	26	22	10	—	—	43	153	196	15	25 9¾	—		(c) 25·8	18/7/29	—	—
		Co. Donegal.	24/4/28	12	4 0	5 4	—	15	21	23	21	27	25	22	19	18	19	7	211	6	217	43	33 1¼	—			—	—	—
‡6	49	Mrs. Mulcahy,	12/3/28	289	3 8	3 12	—	21	23	23	23	25	26	24	21	22	17	4	202	27	229	30	34 8¼	—		(a) 1,225	—	—	Aug.
		Ballinahown,	,,	290	3 8	4 8	—	5	22	22	20	24	26	20	—	3	—	—	63	79	142	18	19 11	—		lbs. ozs dr.	—	—	—
		Ardagh,	,,	291	3 8	4 0	4	19	20	2	7	27	28	23	26	23	23	13	180	35	215	16	30 10½	—	9 1 2	(b) 163 11 2	—	—	Jan.
		Limerick.	,,	292	3 12	4 4	6	23	23	23	22	26	27	25	22	18	22	10	230	8	247	57	38 6¼	—		ozs.	—	—	Sep.
			,,	293	4 4	4 8	2	21	23	2	3	29	29	29	25	25	25	11	220	4	224	46	33 3¾	—		(c) 25·7	—	—	Jan.
			,,	294	3 8	3 8	—	9	18	19	16	21	23	24	19	16	3	—	126	42	168	24	23 10¼	—			—	—	Aug.
‡7	51		4/3/28	301	3 0	4 0	4	22	22	21	20	24	25	26	23	27	25	11	250	—	250	57	38 10	—		(a) 1,163	—	—	June
		Mrs. M. E. Higgins,	,,	302	3 0	3 8	—	13	24	22	4	20	24	17	3	17	20	11	173	2	175	47	27 11½	—		lbs. ozs. dr.	—	—	—
		Carramarla Lodge	,,	303	3 8	4 8	—	19	18	—	15	23	19	19	17	7	19	13	154	15	169	37	25 9¼	—	8 17 11½	(b) 163 5 9	—	—	June
		Claremorris,	,,	304	3 8	4 0	8	24	16	21	14	23	23	23	20	23	20	10	224	1	225	57	35 4¼	—		ozs.	—	—	June
		Co. Mayo.	,,	305	3 0	4 8	—	3	23	21	20	24	22	24	20	23	22	10	211	1	212	35	31 6	—		(c) 27·0	—	—	Sept.
			,,	306	3 8	4 8	9	11	4	7	14	21	25	19	14	8	—	—	116	16	132	20	18 6½	—			—	—	—
‡8	57		10/4/28	337	4 0	4 8	3	12	23	9	18	20	22	24	20	18	9	—	150	28	178	21	25 11¾	—		(a) 1,088	—	—	Sept.
		Mrs. S. Cormack,	,,	338	3 8	5 0	1	23	23	23	21	22	24	22	23	25	25	12	244	—	244	59	38 3¾	—		lbs. ozs. dr.	—	—	Sept.
		Ballykerin,	,,	339	3 8	4 8	7	23	19	20	18	23	20	12	9	18	15	4	183	5	188	54	30 8	—	8 12 0	(b) 151 2 13	—	—	Sept.
		Ballincurry,	,,	340	3 8	4 0	8	24	24	24	23	24	—	19	18	19	15	9	207	—	207	68	34 10½	—		ozs.	—	—	Sept.
		Thurles,	22/4/28	341	3 8	4 8	2	23	23	24	22	25	25	28	27	25	27	11	254	8	262	57	40 4½	—		(c) 26·7	—	—	Sept.
		Co. Tipperary.	10/4/28	342	3 8	—	—	3	—	3	3	—	—	—	—	—	—	—	9	—	9	6	1 9½	—			18/5/29	—	—
‡9	46		8/4/28	271	3 4	3 8	1	23	19	19	19	21	22	22	21	22	22	3	201	13	214	41	33 0½	—		(a) 1,116	—	—	Sept.
		Mrs. M. McFadden,	,,	272	3 4	4 4	—	22	7	19	24	24	23	23	19	17	18	—	180	16	196	37	29 3	—		lbs. ozs. dr.	—	—	Sept.
		Towney,	28/3/28	273	3 0	—	3	20	20	20	21	22	18	—	—	—	—	—	55	69	124	10	19 9	—	8 11 5	(b) 154 6 5	7/5/29	—	—
		Kilcar,	,,	274	3 0	4 4	1	25	5	18	19	20	22	26	24	23	24	10	217	—	217	37	32 10	—		ozs.	—	—	Sept.
		Co. Donegal.	8/4/28	275	3 8	4 8	—	4	13	19	17	18	11	7	11	10	8	7	122	3	125	24	19 4	—		(c) 26·6	—	—	Sept.
			28/3/28	276	3 8	4 4	—	20	22	25	22	26	24	24	24	22	22	9	240	—	240	54	37 2½	—			—	—	Sept.

‡ Also competing in Section V. * Disqualified under Clause 26 (more than 20 per cent. second-grade eggs);

SECTION I.—WHITE LEGHORN—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade.	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet	Untrapped Eggs	Total Value of Eggs from Pen	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
																							s. d.		£ s. d.				
*‡	55	Mrs. B. O'Brien,	10/4/28	325	3 8	4 4	—	20	22	21	19	21	23	26	22	23	23	11	221	10	231	48	35 6¼	1	8 10 11½	(a) 1,219	—	—	Sept.
		Philipstown Cottage,	,,	326	4 0	6 4	—	—	—	15	20	28	28	26	22	29	27	12	205	2	207	1	27 7¾	—		lbs. ozs. dr.	—	—	July
		Cappawhite,	,,	327	3 8	4 0	7	22	22	22	20	27	25	28	24	17	—	—	170	44	214	52	32 3½	—		(b) 161 0 4	—	—	July
		Co. Tipperary.	,,	328	4 0	4 8	—	—	2	24	24	24	27	22	19	20	21	3	112	74	186	10	23 8¼	—		ozs.	—	—	June
			,,	329	4 4	3 8	3	5	—	9	20	26	27	27	20	24	20	3	53	131	184	4	21 5	—		(c) 25·4	—	—	June
			,,	330	3 8	4 0	4	13	22	18	20	19	19	21	19	20	19	2	189	7	196	41	30 2	—			—	—	Sept.
10	7	Mrs. M. G. King,	5/4/28	37	3 8	—	3	17	23	11	17	12	21	15	18	11	1	—	115	34	149	26	22 8½	1	8 4 5¼	(a) 1,067	10/8/29	—	—
		Beechgrove,	,,	38	3 8	5 0	—	18	21	25	22	23	22	22	23	25	24	14	212	27	239	48	36 2¾	—		lbs. ozs. dr.	—	—	—
		Donadea,	,,	39	4 0	4 12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		(b) 149 10 6	—	—	—
		Co. Kildare.	,,	40	4 4	5 0	11	17	24	23	18	22	20	12	4	13	12	5	178	3	181	60	30 0¾	—		ozs.	—	—	Aug.
			,,	41	3 12	5 4	6	25	19	21	19	24	28	24	25	23	25	12	248	3	251	59	38 10½	—		(c) 26·9	—	—	Aug.
			,,	42	3 8	5 4	—	7	29	26	23	26	28	30	26	27	18	6	236	10	246	39	36 5½	—			—	—	June
11	3	Mr. F. C. Bernard,	20/4/28	13	3 0	3 8	6	22	23	23	20	25	25	25	23	26	20	9	210	37	247	39	37 5½	—	8 2 3¼	(a) 1,085	—	—	—
		Belfield,	,,	14	3 8	4 8	—	10	23	19	15	23	22	25	19	20	21	11	208	—	208	40	31 7½	—		lbs. ozs. dr.	—	—	—
		Stillorgan Rd.,	,,	15	3 8	4 4	—	7	—	12	12	11	5	—	—	2	—	—	41	8	49	9	7 10¾	—		(b) 151 2 0	—	—	—
		Donnybrook,	,,	16	3 8	4 4	—	—	3	20	21	25	25	28	24	24	20	11	201	—	201	13	27 5½	—		ozs.	—	—	—
		Dublin.	,,	17	3 0	3 12	9	18	24	23	21	24	25	27	24	22	23	11	247	4	251	58	38 10½	—		(c) 26·7	—	—	—
			,,	18	3 0	3 0	—	—	17	19	20	22	22	15	13	1	—	—	125	4	129	25	18 11½	—			—	—	July
‡12	56	Miss M. E. Anglim,	27/3/28	331	4 8	4 0	8	21	22	22	19	25	24	24	24	17	17	2	218	7	225	56	35 1½	—	8 1 0	(a) 1,029	—	—	—
		Farranaleen,	,,	332	3 8	3 2	11	21	20	2	15	23	22	23	24	19	20	—	153	47	200	25	29 2¾	—		lbs. ozs. dr.	—	—	—
		Fethard,	,,	333	3 8	—	—	11	15	11	—	—	—	—	—	—	—	—	14	23	37	14	7 5¾	—		(b) 138 4 7	19/1/29	—	—
		Co. Tipperary.	30/3/28	334	4 0	3 12	8	23	21	18	19	23	22	21	19	22	20	2	216	2	218	59	34 6	—		ozs.	—	—	Sept.
			,,	335	4 0	4 0	9	16	13	2	—	13	11	16	11	11	2	1	103	2	105	38	16 10¼	—		(c) 25·8	—	—	Sept.
			,,	336	3 8	4 0	12	20	22	16	19	22	25	26	25	24	23	10	243	1	244	62	37 9¾	—			—	—	Sept.
‡13	53	Miss K. Martin,	April	313	3 4	—	11	25	26	21	21	24	19	3	—	—	—	—	126	24	150	49	26 1½	2	7 17 8½	(a) 1,048	12/7/29	—	—
		The Mountain,	,,	314	3 4	3 12	1	24	22	18	19	24	26	27	25	28	25	8	245	2	247	56	37 11¾	—		lbs. ozs. dr.	—	—	Sept.
		St. John's,	,,	315	3 0	4 0	—	7	2	22	18	23	25	24	21	22	22	10	189	7	196	17	27 6¼	—		(b) 141 6 12	—	—	June
		Knockcroghery,	,,	316	3 8	3 8	—	16	19	22	23	22	18	1	—	—	—	—	29	92	121	19	18 4½	—		ozs.	—	—	—
		Co. Roscommon.	,,	317	3 0	4 0	—	8	23	19	13	21	23	24	15	17	13	8	179	5	184	38	27 9¼	—		(c) 25·9	—	—	—
			,,	318	3 0	3 12	—	—	8	12	—	19	24	25	24	22	14	—	146	2	148	17	19 7½	—			—	—	Sept.

‡ Also competing in Section V. * Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION I.—WHITE LEGHORN—*continued*.

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	16th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade.	Total.	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet.	Untrapped Eggs.	Total Value of Eggs from Pen	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
			10/3/28	319	4 8	4 4	—	—	—	—	9	4	—	5	7	5	—	—	9	21	30	—	s. d. 3 5	1	£ s. d.	(a) 1,047	—	—	June & Sept.
‡14	54	Mrs. M. Cryan,	,,	320	3 8	2 8	—	11	10	—	4	21	24	24	17	20	4	—	135	—	135	21	18 8¾	—		lbs. ozs. dr.	—	—	June
		Scefin,	,,	321	3 0	4 0	—	21	25	22	22	20	23	20	19	17	18	6	211	2	213	55	33 10½	—	7 16 1	(b) 142 11 3	—	—	Sept.
		Cloonloo,	,,	322	3 8	4 12	—	17	23	23	21	23	26	27	24	22	23	11	168	72	240	45	34 10½	—		ozs.	—	—	Sept.
		Boyle,	,,	323	3 8	4 0	—	5	24	15	21	24	25	28	27	25	22	7	207	16	223	34	32 1¼	—		(c) 26·2	—	—	June
		Co. Roscommon.	,,	324	3 8	4 4	4	25	23	23	20	25	23	22	18	15	7	—	205	—	205	63	33 0	—			—	—	Sept.
			28/4/28	1	3 8	4 8	1	18	23	23	22	22	20	26	24	25	24	11	160	79	239	3	34 6½	2		(a) 1,080	—	—	—
*	1	Mrs. S. P. Dobbin,	,,	2	3 4	4 8	—	19	25	22	21	21	6	—	—	—	—	—	71	44	115	14	19 11	—		lbs. ozs. dr.	—	—	Aug.
		Knockreigh,	,,	3	3 0	3 8	—	—	—	2	5	11	11	4	—	—	—	—	5	28	33	—	3 5½	—	7 14 4½	(b) 135 4 3	—	—	July
		Blackroad Rd.,	,,	4	3 4	4 0	—	8	13	20	19	21	20	27	23	22	24	12	122	87	209	12	28 3¼	—		ozs.	—	—	—
		Cork.	,,	5	3 4	3 8	—	10	24	19	23	25	24	26	22	23	22	13	98	133	231	4	31 4¾	—		(c) 24·0	—	—	—
			,,	6	3 4	3 12	1	23	23	25	19	25	27	27	25	22	27	7	172	79	251	25	36 7	—			—	—	—
			Feb.	277	3 8	3 12	11	23	22	19	21	26	25	28	24	24	15	5	213	30	243	63	37 1¼	—		(a) 1,009	—	—	—
§‡	47	Mrs. M. McMahon,	,,	278	3 0	4 0	8	17	15	2	18	26	24	26	18	15	—	10	172	7	179	36	26 6½	—		lbs. ozs. dr.	—	—	—
		Gaybrook,	,,	279	3 12	4 0	7	16	25	21	22	27	21	13	—	7	—	—	142	17	159	49	26 0¾	—	7 13 0¾	(b) 138 5 7	—	—	—
		Malahide,	,,	280	3 0	4 0	—	—	16	24	21	23	24	24	21	22	21	3	196	3	199	24	28 6¾	—		ozs.	—	—	Sept.
		Co. Dublin.	,,	281	3 4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		(c) 26·3	21/2/29	—	—
			,,	282	4 8	4 8	—	13	23	21	19	26	26	20	23	25	22	11	229	—	229	45	34 9	—			—	—	—
			March	55	4 0	4 8	6	21	20	6	17	11	10	5	2	—	4	—	63	39	102	15	17 3	2		(a) 878	—	—	—
§	10	Mrs. G. Galway-Greer,	,,	56	4 8	—	—	16	13	—	—	—	—	—	—	—	—	—	28	1	29	28	6 11¼	—		lbs. ozs. dr.	28.12.28	—	—
		Rooske Lodge,	,,	57	3 8	4 8	8	23	16	23	18	26	22	24	23	23	17	13	232	4	236	56	36 9¼	—	7 0 1¾	(b) 119 8 15	—	—	—
		Dunboyne,	,,	58	3 4	—	14	25	12	23	9	19	11	12	2	—	1	—	110	18	128	47	22 3½	—		ozs.	8/8/29	—	—
		Co. Meath.	,,	59	4 0	5 8	—	11	22	21	19	20	22	15	13	16	17	9	169	16	185	39	28 5	—		(c) 26·1	—	—	July
			,,	60	3 8	4 8	7	8	9	17	21	21	22	21	22	22	14	12	178	18	196	32	28 2¾	—			—	—	—
			1/4/28	307	4 0	4 4	9	3	—	3	7	24	25	27	12	15	15	—	138	2	140	11	18 5½	1'		(a) 904	—	—	—
‡§	52	Mrs. M. A. Walsh	,,	308	3 0	—	5	14	10	—	—	—	—	—	—	—	—	—	20	9	29	20	6 5¼	—		lbs. ozs. dr.	10/3/29	—	—
		Wardstown,	,,	309	3 12	4 4	7	20	20	12	15	21	24	22	24	23	17	8	182	31	213	22	31 8¼	—	6 11 9¾	(b) 124 5 9	—	—	Sept.
		Athboy,	,,	310	4 4	4 8	2	18	9	6	19	20	20	21	15	8	—	—	137	1	138	28	20 8¼	—		ozs. (c) 26·4	—	—	June & Aug.
		Co. Meath.	,,	311	3 8	3 0	4	12	20	15	17	21	23	24	20	16	12	—	90	94	184	28	25 6	—			—	—	Aug.
			,,	312	3 4	4 0	—	1	21	18	16	23	24	24	22	21	23	6	199	—	199	32	28 10¾	—			—	—	Nov. & Sept.

‡ Also competing in Section V. § Disqualified under Clause 26 (pen produced less than 1,020 eggs). * Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION I.—WHITE LEGHORN—*continued.*

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	16th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade.	Total.	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet. s. d.	Untrapped Eggs.	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
*§	11	Finuisk Lodge Poultry Farm, Cappoquin, Co. Waterford	25/3/28	61	3 0	4 8	—	—	7	22	22	22	26	25	23	14	22	11	184	10	194	10	26 9¾	—	5 7 1¾	(a) 743; (b) lbs. ozs. dr. 95 13 4; (c) ozs. 24·8	—	1	Aug. & Nov.
			,,	62	3 0	4 0	2	12	5	12	6	6	8	6	—	—	—	—	50	7	57	20	9 10½	—			—	—	—
			,,	63	3 0	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	1	—	0 2½	—			26.12.28	—	Nov.
			,,	64	3 0	4 2	—	16	25	25	24	27	26	18	25	26	25	12	64	185	249	2	33 2¼	—			—	1	—
			15/2/28	65	3 8	—	—	12	14	15	11	16	17	—	—	—	—	—	82	3	85	36	14 5¾	—			13/5/29	—	—
			,,	66	3 0	4 4	—	—	15	24	21	22	24	20	13	5	7	6	139	18	157	25	22 7				—	—	Nov.

* Disqualified under Clause 26 (more than 20 per cent. second-grade-eggs). § Disqualified under Clause 26 (pen produce less than 1,020 eggs).

SECTION II.—WHITE WYANDOTTE.

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	16th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade.	Total.	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet. s. d.	Untrapped Eggs.	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
1	27	Mrs. J. Murphy,	21/2/28	157	5 0	5 12	12	24	25	22	21	28	25	24	20	18	23	13	251	4	255	69	40 6¾	—		(a) 1,473	—	—	July
		Newrath,	,,	158	5 8	6 8	7	23	23	19	21	22	21	20	20	9	24	12	103	118	221	1	32 0	—		lbs. ozs. dr.	—	1	Aug.
		Waterford.	,,	159	5 0	6 4	12	24	23	20	20	26	23	25	23	26	22	12	238	18	256	50	39 10	—	11 5 2¾	(b) 192 14 5	—	—	Aug.
			,,	160	5 0	5 4	12	19	24	24	24	21	23	24	15	18	11	1	213	3	216	66	34 6¾	—		ozs.	—	—	Aug.& Sept.
			,,	161	5 0	5 4	12	27	24	23	19	25	27	28	28	26	26	13	278	—	278	75	43 9	—		(c) 25·1	—	—	Aug.
			,,	162	4 8	4 12	3	23	20	24	21	26	24	27	25	21	23	10	117	130	247	7	34 6¼	—			—	—	Aug.
2	19	Mrs. M. McDowell,	26/2/28	109	4 8	5 4	7	23	18	20	19	22	25	26	22	23	21	12	234	4	238	55	36 10½	—		(a) 1,427	—	—	Aug.
		Dunany,	,,	110	4 8	5 12	9	23	24	23	19	21	22	26	28	26	18	9	230	18	248	63	38 6¾	—		lbs. ozs. dr.	—	—	Aug.
		Dunleer,	,,	111	4 8	5 8	13	20	23	23	19	24	24	17	23	24	7	15	222	10	232	64	36 6¾	—	11 1 8½	(b) 191 0 11	—	2	Aug. & Sept.
		Co. Louth.	,,	112	4 4	5 4	—	22	24	22	22	27	26	27	26	28	27	13	260	4	264	53	40 6½	—		ozs.	—	—	Aug.
			,,	113	4 0	4 12	9	22	23	22	22	27	27	22	22	12	26	12	192	54	246	44	37 4	—		(c) 25·7	—	1	Aug.
			,,	114	4 0	5 4	1	26	15	21	10	21	19	18	17	25	22	14	195	4	199	52	31 10	—			—	6	Aug.
3	14	Mrs. N. Chearnley,	22/2/28	79	5 8	4 12	10	23	24	23	20	23	25	24	22	21	24	12	251	—	251	68	39 10	2		(a) 1,381	—	—	Aug.
		Glendoneen,	,,	80	6 0	6 8	10	29	24	25	23	27	14	5	—	—	—	—	146	11	157	74	28 3¾	—		lbs. ozs. dr.	—	—	—
		Ballinhassig,	20/1/28	81	5 4	5 4	13	20	26	10	12	27	28	29	24	27	21	13	231	19	250	64	37 11¾	—	11 0 9¼	(b) 180 2 2	—	—	Aug.
		Co. Cork.	30/1/28	82	5 0	5 8	12	24	25	23	23	27	22	19	22	19	18	16	233	17	250	71	39 9¼	—		ozs.	—	2	Aug.
			12/2/28	83	4 8	4 12	13	25	28	26	25	30	29	19	12	16	24	13	214	46	260	63	41 0½	—		(c) 25·0	—	3	July
			30/1/28	84	4 12	5 0	11	25	22	22	22	26	23	23	17	12	5	3	185	26	211	67	33 6½	—			—	—	Aug.
4	16	Mrs. R. B. Eadie,	6/3/28	91	5 0	6 0	13	25	20	21	16	24	26	24	13	17	23	12	232	2	234	67	37 5½	—		(a) 1,283	—	1	June
		The Poplars,	,,	92	4 8	4 8	13	20	26	24	19	25	22	23	10	25	24	11	141	101	242	21	36 0	—		lbs. ozs. dr.	—	1	Aug.
		Beaufort,	,,	93	4 8	5 2	8	23	23	24	22	26	24	17	20	13	25	12	217	20	237	58	37 6½	—	10 6 1¼	(b) 167 14 5	—	—	Aug.
		Co. Kerry.	,,	94	5 0	4 12	9	21	23	17	19	24	18	16	18	21	24	8	208	10	218	56	34 8½	—		ozs.	—	—	Aug.
			,,	95	4 8	5 4	9	23	21	22	18	22	23	20	11	12	15	9	185	20	205	45	32 8¾	—		(c) 25·1	—	—	July
			,,	96	5 4	6 8	13	26	26	25	25	26	6	—	—	—	—	—	146	1	147	75	27 8	—			—	—	July
5	18	Mrs. B. Deegan,	28/3/28	103	5 0	5 4	12	25	25	20	17	24	12	4	9	7	3	10	168	—	168	71	29 7	1		(a) 1,252	—	—	June& Sept.
		Lodge Park,	,,	104	5 0	5 2	13	24	22	22	20	23	27	6	12	14	15	2	168	32	200	51	32 1¼	—		lbs. ozs. dr.	—	4	June & Aug.
		Freshford,	,,	105	4 8	4 12	13	23	27	23	21	24	24	14	13	15	15	—	200	12	212	66	34 7	—	10 3 9½	(b) 172 0 12	—	4	June & July
		Co. Kilkenny.	,,	106	5 0	5 8	5	16	25	18	19	26	25	28	20	23	25	8	237	1	238	53	36 7¼	—		ozs.	—	—	—
			,,	107	5 0	—	13	24	20	26	21	22	25	19	—	—	—	—	167	3	170	66	28 10	—		(c) 26·4	23/5/29	—	—
			,,	108	5 0	5 12	12	26	24	24	23	27	25	27	23	14	25	13	262	1	263	74	41 11½	—			—	—	Aug.

SECTION II.—WHITE WYANDOTTE—*continued.*

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	15th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade.	Total.	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet.	Untrapped Eggs.	Total Value of Eggs from Pen	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
																							s. d.		£ s. d.				
*†	60	Mrs. Jane Lehane, Crossmahon, Lissarda, Co. Cork.	28/2/28	355	5 0	5 4	12	19	21	21	18	26	27	29	26	25	24	12	258	2	260	60	39 11	—	10 1 10¾	(a) 1,320 lbs. ozs. dr. (b) 170 14 1 ozs. (c) 24·7	—	—	Sept.
			21/3/28	356	5 8	5 8	13	22	24	22	21	24	23	28	15	23	14	13	204	38	242	47	37 5½	—			—	2	Sept.
			17/3/28	357	4 8	5 8	10	26	23	22	16	23	9	9	3	—	—	—	32	109	141	2	22 4¼	—			—	—	—
			,,	358	5 0	5 0	12	8	21	25	23	25	23	19	16	18	18	11	76	143	219	5	30 0½	—			—	—	Sept
			,,	359	5 8	5 4	13	25	27	23	19	14	20	20	15	20	15	5	214	2	216	75	35 9½	—			—	4	Sept.
			,,	360	5 0	5 0	7	23	26	21	20	26	25	24	26	15	26	12	147	104	251	5	36 4	—			—	1	Sept.
6*	67	Mrs. K. Mullen, Oristown, Kells, Co. Meath.	26/3/28	397	5 8	5 12	3	17	19	8	17	20	23	21	19	19	14	3	180	3	183	42	27 10½	—	10 0 11¼	(a) 1,288 lbs. ozs. dr. (b) 174 0 4 ozs. (c) 25·9	—	—	Sept.
			,,	398	4 8	5 4	—	24	25	25	19	25	26	26	24	23	23	12	246	6	252	58	39 3¾	—			—	—	Sept.
			,,	399	4 4	5 0	1	23	23	22	18	24	22	15	23	13	11	10	203	2	205	56	32 10½	—			—	2	Sept.
			,,	400	4 4	5 0	—	21	22	7	23	30	15	18	17	15	16	15	189	10	199	39	31 1¼	—			—	4	Sept.
			,,	401	4 0	5 0	10	20	24	23	22	24	22	19	16	21	20	6	165	62	227	32	34 6	—			—	—	—
			,,	402	4 8	5 0	11	23	25	22	18	21	24	24	19	15	16	4	208	14	222	56	35 3¾	—			—	—	—
7*	65	Miss A. Donegan, Monasterboice, Drogheda, Co. Louth.	9/2/28	385	4 8	—	14	23	25	24	19	17	12	8	11	5	—	—	157	1	158	73	28 0	—	9 16 6¾	(a) 1,167 lbs. ozs. dr. (b) 161 8 0 ozs. (c) 26·6	16/7/29	—	—
			,,	386	5 0	—	5	20	23	22	17	18	15	13	11	13	11	4	172	—	172	58	28 9¼	—			15/9/29	—	Sept.
			,,	387	5 8	6 12	12	24	23	23	22	22	21	19	24	22	16	6	233	1	234	70	37 6¼	—			—	—	—
			,,	388	4 8	6 0	14	23	28	21	21	23	26	12	12	19	14	13	225	1	226	74	37 2	—			—	3	June & Sept.
			,,	389	4 8	5 8	14	26	26	23	20	10	13	10	5	2	3	—	149	3	152	73	27 7¾	—			—	—	Sept.
			,,	390	4 8	5 4	7	25	22	23	22	27	22	17	16	12	20	12	222	3	225	63	37 5½	—			—	2	—
*†	61	Miss J. O'Keefe, Ballybooden House, Knocktopher, Co. Kilkenny.	16/3/28	361	5 0	5 8	—	14	24	25	23	26	28	16	17	15	17	4	201	8	209	44	32 2¼	—	9 16 4	(a) 1,297 lbs. ozs. dr. (b) 168 9 7 ozs. (c) 25·0	—	2	Sept.
			,,	362	4 8	4 4	11	23	22	22	21	22	24	24	26	25	22	2	242	2	244	64	38 3½	—			—	—	June
			,,	363	4 8	4 8	12	24	23	21	20	23	25	20	18	14	20	5	121	104	225	32	33 4¼	—			—	—	Sept.
			,,	364	4 12	5 0	11	19	18	9	—	19	19	18	17	21	19	2	132	40	172	40	26 0¾	—			—	—	—
			,,	365	4 8	4 2	8	23	23	20	20	22	25	24	21	21	25	4	218	18	236	49	36 7	—			—	—	—
			,,	366	5 0	—	6	27	27	26	18	27	27	17	23	12	1	—	55	156	211	6	29 10¼	—			16/8/29	—	—
8	17	Mrs. M. Barker, The Rectory, Celbridge, Co. Kildare.	10/3/28	97	5 0	6 0	12	21	24	20	14	19	12	4	6	6	5	—	53	90	143	19	23 9	—	9 14 6¾	(a) 1,233 lbs. ozs. dr. (b) 162 15 7 ozs. (c) 25·4	—	1	Aug.
			,,	98	5 0	6 4	14	26	25	23	20	22	25	21	17	15	12	5	203	22	225	53	36 0¼	—			—	—	Aug.
			,,	99	5 0	5 12	9	22	22	22	19	21	22	21	19	16	11	—	197	7	204	57	32 6½	—			—	—	Aug.
			,,	100	5 0	7 0	—	19	21	15	19	21	24	23	17	15	8	2	177	7	184	42	28 3¾	—			—	—	Aug.
			,,	101	4 8	5 8	9	23	21	22	19	20	23	22	20	13	22	9	200	23	223	46	34 11¾	—			—	1	Aug.
			,,	102	5 4	6 8	13	24	24	22	15	24	24	28	23	20	24	13	214	40	254	33	38 11½	—			—	—	Aug.

* Also competing in Section VI (Station Holders). † Disqualified under Clause 26 (more than 20% second-grade eggs).

SECTION II.—WHITE WYANDOTTE—*continued.*

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test. lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	16th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan	Value per Pullet. s. d.	Untrapped Eggs.	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
9	26	Mrs. M. Drohan	March	151	4 8	—	9	19	23	24	22	24	23	15	—	—	—	—	94	65	159	19	24 11	—		(a) 1,231	29/6/29	1	June
		Ballynevin,	,,	152	5 0	5 0	12	26	26	24	22	25	24	14	13	17	1	12	167	49	216	28	34 0	—		lbs. ozs. dr.	—	2	—
		Carrick-on-Suir,	,,	153	3 12	—	13	26	21	18	13	26	28	30	3	—	—	—	116	62	178	17	27 2¾	—	9 14 4½	(b) 159 8 2	10/6/29	—	—
		Co. Waterford.	,,	154	5 0	5 12	11	26	26	25	22	26	23	18	22	5	19	11	204	30	234	46	37 2½	—		ozs.	—	1	July
			,,	155	4 8	5 0	—	23	26	15	16	17	20	7	18	10	16	9	149	18	167	37	27 4	—		(c) 24·9	—	6	May
			,,	156	4 8	5 4	13	26	27	26	22	27	28	30	26	11	28	13	262	15	277	73	43 8¼	—				1	—
10*	75	Miss E. O'Donoghue,	March	445	5 0	5 12	10	24	26	23	23	24	26	25	22	17	18	3	241	—	241	72	38 5½	1		(a) 1,213	—	—	Sept
		Killeigh,	,,	446	4 8	5 0	—	16	22	25	19	23	19	16	13	21	19	4	197	—	197	51	31 4¾	—		lbs. ozs. dr.	—	—	June
		Cahir,	,,	447	4 8	4 4	—	22	26	24	19	7	21	21	15	14	4	10	182	1	183	59	30 1½	—	9 13 3¾	(b) 165 12 4	—	3	Mar.
		Co. Tipperary.	,,	448	4 12	5 8	13	24	27	26	19	25	20	23	5	6	26	7	216	5	221	77	36 11½	—		ozs.	—	—	Sept.
			,,	449	4 0	—	—	13	23	23	18	20	24	19	—	—	—	—	25	115	140	4	20 1¼	—		(c) 26·2	29/5/29	—	—
			,,	450	4 8	4 12	8	20	24	23	24	26	24	23	15	17	10	16	212	18	230	56	36 1¼	—			—	3	June
11	25	Miss P. White,	March	145	4 8	5 4	9	21	20	4	11	20	22	25	24	20	21	10	183	24	207	30	31 2¾	—		(a) 1,254	—	—	Aug.
		Gortnafluir,	,,	146	4 8	5 4	5	17	8	21	17	11	17	12	11	11	11	8	96	53	149	19	22 3¼	—		ozs. lbs. dr.	—	2	July
		Clonmel.	,,	147	5 8	6 0	8	23	21	17	19	20	20	26	9	9	14	6	185	7	192	52	31 0¼	—	9 11 9	(b) 167 7 1	—	—	Aug
		Co. Tipperary.	,,	148	4 8	5 0	5	25	25	23	23	24	25	20	27	20	23	8	215	33	248	37	38 1¼	—		ozs.	—	—	Aug.
			,,	149	5 0	6 4	—	19	22	21	19	22	24	21	24	23	22	12	228	1	229	51	35 1	—		(c) 25·6	—	—	—
			,,	150	4 8	5 12	—	4	25	25	22	22	27	23	22	25	21	13	225	4	229	37	34 0½	—			—	—	Aug.
12	13	Mr. D. V. O'Grady,	Feb.	73	5 0	—	—	20	22	19	19	26	24	28	2	—	—	—	158	2	160	50	25 10¼	1		(a) 1,219	3/6/29	—	—
		Minaville,	,,	74	4 8	5 4	1	21	25	23	20	24	24	25	23	22	20	13	239	2	241	57	37 8¼	—		lbs. ozs. dr.	—	—	May & Sept.
		Glanmire,	,,	75	4 12	7 4	—	8	21	22	17	21	21	22	16	16	17	2	183	—	183	40	27 11	—	9 11 0½	(b) 174 1 12	—	—	Sept.
		Co. Cork.	,,	76	4 12	5 12	—	26	25	27	25	22	25	15	18	20	19	13	235	—	235	65	38 0¼	—		ozs.	—	1	May
			,,	77	4 0	4 12	—	9	19	24	21	24	22	21	14	13	21	10	197	1	198	39	30 3¾	—		(c) 27·4	—	—	—
			,,	78	4 8	5 4	—	15	24	22	20	22	17	22	17	16	13	13	176	25	201	45	31 1½	—			—	4	Sept.
13	22	Miss P. Brady,	19/3/28	127	5 0	4 12	14	25	26	24	23	27	28	28	23	15	18	8	259	—	259	76	41 2¾	—		(a) 1,169	—	—	—
		Newtowngirley,	,,	128	5 0	4 8	14	28	29	24	25	26	27	19	23	18	9	7	249	—	249	83	40 6¼	—		lbs. ozs. dr.	—	1	Aug.
		Kells,	,,	129	5 0	3 12	12	27	26	25	16	19	14	10	14	7	—	—	122	48	170	50	28 5¾	—	9 8 11¾	(b) 165 5 14	—	1	July
		Co. Meath.	,,	130	5 8	—	7	19	26	18	16	21	21	20	18	3	—	—	164	5	169	60	27 5¾	—		ozs.	8/7/29	—	—
			,,	131	5 8	8 0	—	—	7	21	18	25	23	4	4	8	3	—	111	2	113	16	16 4	—		(c) 27·2	—	1	July
			,,	132	4 8	5 8	—	27	28	25	22	18	19	22	11	8	18	11	206	3	209	66	34 11½	—			—	3	June &Aug

* Also competing in Section VI.

SECTION II.—WHITE WYANDOTTE—*continued*.

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
14*	74	Miss H. Frewen, Rossboy, Glen-of-Aherlow, Co. Tipperary.	Feb.	439	5 4	5 4	—	21	23	21	15	25	28	26	21	21	27	2	229	1	230	54	35 5½	—	9 4 11	(a) 1,211; (b) 166 lbs. 7 ozs. 6 dr.; (c) 26·4 ozs.	—	—	June
			March	440	4 12	6 4	—	—	—	—	5	17	22	15	11	4	4	4	81	1	82	—	9 10¾	—			—	—	June & Nov.
			,,	441	4 0	5 0	—	1	23	19	21	23	22	18	19	10	16	4	169	7	176	27	26 0¼	—			—	—	Sept.
			Feb.	442	5 0	5 12	4	22	24	23	21	26	23	28	17	28	25	13	254	—	254	62	39 10¾	—			—	1	June
			,,	443	5 0	5 0	11	25	27	26	23	28	25	28	23	11	20	10	250	7	257	76	41 0¼	—			—	1	June & Sept.
			,,	444	4 8	6 0	2	8	28	29	27	26	26	18	11	15	17	5	190	22	212	51	32 7½	—			—	4	Sept.
*†‡	66	Sr. M. Patrick, Technical Schools, Claremorris, Co. Mayo.	7/2/28	391	4 4	2 4	12	25	26	22	22	27	23	20	23	22	—	—	73	149	222	22	31 8	2	9 2 0	(a) 1,250; (b) 154 lbs. 0 ozs. 1 dr.; (c) 23·7 ozs.	—	—	—
			,,	392	4 8	5 4	—	20	25	26	21	27	23	22	14	12	14	5	25	184	209	4	28 4½	—			—	—	Sept.
			,,	393	4 8	5 0	13	28	27	26	23	24	23	20	20	10	22	9	120	125	245	14	36 7¾	—			—	1	—
			,,	394	4 8	4 12	5	—	—	—	17	27	12	26	11	19	15	11	82	61	143	3	17 7¼	—			—	2	—
			,,	395	4 8	5 8	13	28	27	25	25	27	25	11	13	15	17	7	128	105	233	20	35 5½	—			—	2	June
			,,	396	4 8	5 8	—	21	26	22	21	22	12	24	15	14	17	2	191	5	196	55	31 10¼	—			—	4	Sept.
15	104	Miss M. Greene, Hill House, Lecarrow, Co. Roscommon.	25/2/28	603	4 8	7 0	—	26	29	29	27	28	23	23	16	22	17	4	244	—	244	69	39 4¾	—	8 18 7¾	(a) 1,126; (b) 169 lbs. 2 ozs. 5 dr.; (c) 28·8 ozs.	—	—	June
			,,	604	4 0	6 4	—	18	28	29	22	27	25	19	18	11	18	9	224	—	224	61	35 9	—			—	—	Aug.
			26/2/28	605	4 0	6 0	—	1	21	19	14	18	21	8	13	14	15	—	144	—	144	33	21 10	—			—	1	Oct.
			,,	606	4 0	—	—	4	22	30	26	31	17	—	—	—	—	—	130	—	130	40	21 6	—			27/4/29	—	Oct. & Nov.
			,,	607	4 4	6 4	—	15	28	25	27	20	24	17	14	13	19	10	212	—	212	55	33 11	—			—	3	Oct. & June
			,,	608	4 0	8 0	—	1	22	24	25	28	21	9	13	10	15	4	172	—	172	35	26 3	—			—	2	Nov. & Aug.
16	15	Mr. R. N. Tweedy, Hinchoge, Carrickmines, Co. Dublin.	Feb.	85	4 8	5 8	—	—	—	21	21	28	29	27	26	24	25	10	200	11	211	5	28 2	1	8 17 11½	(a) 1,173; (b) 155 lbs. 3 ozs. 12 dr.; (c) 25·4 ozs.	—	—	Nov. & Aug.
			,,	86	5 0	6 0	11	25	27	22	22	23	16	18	13	17	9	14	203	14	217	73	35 9¾	—			—	3	June & Nov.
			,,	87	4 12	5 8	14	27	26	18	21	25	29	17	16	16	21	3	226	7	233	74	37 6¾	—			—	3	July
			,,	88	4 8	6 0	3	6	14	10	—	—	8	7	20	12	15	12	80	27	107	27	16 1½	—			—	1	—
			Jan.	89	4 8	4 12	—	—	—	7	20	25	25	24	25	25	24	13	186	2	188	—	24 8¾	—			—	—	Nov. Aug.
			,,	90	5 0	5 0	13	23	24	26	23	22	18	12	17	17	11	10	199	17	216	66	35 4¼	—			—	4	June & July
17*	64	Mrs. J. M. Walsh, Ballyvoreen House, Murroe, Co. Limerick.	4/3/28	379	4 8	5 4	—	—	9	23	21	26	27	28	26	25	28	12	216	9	225	17	31 2¾	—	8 16 0½	(a) 1,153; (b) 153 lbs. 4 ozs. 3 dr.; (c) 25·5 ozs.	—	—	Sept.
			,,	380	4 0	5 4	6	25	21	16	19	24	21	—	7	11	6	1	157	—	157	62	26 9¼	—			—	—	Sept.
			,,	381	4 0	5 0	11	23	21	22	19	22	19	20	20	20	17	6	214	6	220	61	35 3	—			—	—	—
			,,	382	4 8	6 0	7	18	24	20	20	23	24	26	20	24	19	13	230	8	238	53	36 10½	—			—	—	Sept.
			,,	383	4 0	5 8	8	22	27	13	19	28	26	14	8	12	7	—	117	67	184	44	28 1¼	—			—	1	Sept
			,,	384	5 0	5 4	1	6	6	5	7	20	20	18	8	16	10	12	116	13	129	9	17 9¾	—			—	1	—

* Pen also competing in Section VI.

‡ Disqualified under Clause 24 (Eggs failed to reach standard weight of 24 ozs. per dozen).

† Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION II.—WHITE WYANDOTTE—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade.	No. of Second Grade	Total.	First Grade Eggs, 16th Oct. 15th Jan.	Value per Pullet	Untrapped Eggs	Total Value of Eggs from Pen	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
																							s. d.		£ s. d.				
18	20	Mrs. M. Strong, Moate House, Kells, Co. Meath.	19/2/28	115	5 4	5 4	11	24	8	28	25	27	23	17	17	22	20	11	222	11	233	50	36 3½	—	8 13 4½	(a) 1,083 lbs. ozs. dr. (b) 145 13 15 ozs. (c) 25·9	—	3	June
			6/2/28	116	5 0	6 2	3	27	27	23	22	20	17	17	15	13	14	7	204	1	205	70	34 3¼	—			—	—	—
			3/3/28	117	4 8	6 4	8	24	21	23	16	24	21	23	22	19	21	12	95	139	234	19	33 5¼	—			—	—	Aug.
			16/2/28	118	5 0	6 0	—	—	3	25	22	16	10	19	15	7	19	7	128	15	143	13	20 6	—			—	3	Oct. & July
			25/1/28	119	4 8	5 4	7	20	22	14	12	16	17	14	9	9	10	3	151	2	153	54	25 6	—			—	—	Aug.
			13/2/28	120	5 0	—	12	26	26	25	19	7	—	—	—	—	—	—	110	5	115	74	23 4½	—			8/7/29	—	—
19*	70	Miss C. Sweeney, Cloonroan House, Castlerea, Co. Roscommon.	1/3/28	415	4 4	4 12	3	23	26	25	12	25	18	20	12	6	13	2	132	53	185	48	29 4½	—	8 12 10¼	(a) 1,117 lbs. ozs. dr. (b) 154 0 2 ozs. (c) 26·5	—	5	May
			,,	416	4 8	4 12	—	15	24	19	5	29	20	27	20	17	7	11	179	15	194	42	29 5½	—			—	4	Sept.
			,,	417	4 4	4 0	12	24	23	14	11	22	25	20	17	19	16	6	207	2	209	65	33 5¼	—			—	1	Sept.
			,,	418	4 8	—	—	5	14	8	—	—	—	—	—	—	—	—	20	7	27	20	5 9½	—			16/2/29	—	—
			,,	419	4 0	6 0	—	7	25	25	22	22	28	27	24	15	15	12	222	—	222	44	33 4	—			—	—	June
			,,	420	4 0	5 0	—	5	30	25	26	30	30	31	30	29	29	15	279	1	280	46	41 5½	—			—	—	Sept.
*‡	76	Mrs. J. Tomkins, Ballygullen, Craanford, Gorey, Co. Wexford.	March	451	4 0	—	—	22	24	24	21	25	25	19	9	—	—	—	44	125	169	5	24 1¾	—	8 11 4¾	(a) 1,102 lbs. ozs. dr. (b) 146 7 12 ozs. (c) 25·5	28/8/29	—	—
			,,	452	4 8	4 4	9	20	21	20	19	21	23	17	15	16	10	10	196	5	201	57	32 1	—			—	1	Sept.
			,,	453	5 0	5 12	9	20	25	23	22	26	20	25	10	21	6	1	205	3	208	62	33 5¾	—			—	—	Sept.
			,,	454	5 0	5 4	2	25	21	22	17	19	15	19	17	13	7	4	172	9	181	53	29 7	—			—	2	June
			,,	455	4 8	5 12	—	17	29	25	20	20	16	18	17	7	12	8	169	20	189	46	30 5¼	—			—	2	April
			,,	456	4 0	4 2	—	14	22	22	19	19	21	21	16	—	—	—	50	104	154	19	21 8	—			—	—	Aug.
‡	105	Miss E. Cavanagh, Kimmage Grove, Terenure, Dublin.	March & April	609	4 8	4 12	—	13	27	27	22	29	28	22	23	25	25	9	214	36	250	37	37 2¼	—	8 10 7	(a) 1,116 lbs. ozs. dr. (b) 144 15 12 ozs. (c) 25·0	—	—	Aug.
			,,	610	5 4	5 8	6	23	15	17	21	11	16	19	14	16	17	15	180	10	190	50	30 5¼	—			—	6	June & Aug.
			,,	611	5 0	4 8	—	2	4	8	2	9	12	4	3	—	—	—	4	40	44	2	5 4¾	—			—	—	Aug.
			,,	612	5 0	6 4	—	19	22	23	20	25	26	28	24	22	24	11	205	39	244	34	36 2½	—			—	—	Aug.
			,,	613	4 0	4 12	5	18	27	27	21	28	18	12	4	—	—	—	112	48	160	21	25 9½	—			—	—	Aug.
			,,	614	4 0	4 4	13	25	24	23	23	24	16	20	18	20	14	8	167	61	228	38	35 6¾	—			—	—	Sept.
†‡	29	Mr. C. F. Harvey, Duffcarrig, Gorey, Co. Wexford.	12/3/28	169	5 8	5 8	7	24	22	18	16	23	20	26	10	15	19	11	81	130	211	16	30 6	—	8 9 8½	(a) 1,165 lbs. ozs. dr. (b) 142 3 14 ozs. (c 23·4	—	1	Aug.
			7/3/28	170	5 0	5 8	12	27	27	23	20	15	9	—	—	—	12	9	60	94	154	15	25 11½	—			—	—	April
			12/3/28	171	5 8	6 4	1	24	24	11	16	26	25	25	15	24	18	13	7	215	222	1	28 9	—			—	2	Aug.
			,,	172	4 12	5 12	11	21	18	14	13	17	15	9	10	9	9	4	27	123	150	2	21 8¼	—			—	—	Aug.
			22/2/28	173	5 12	6 8	9	18	16	2	5	27	29	28	27	5	27	13	206	—	206	45	30 7¼	—			—	1	Aug.
			12/3/28	174	5 8	5 4	13	26	29	21	10	23	21	14	16	22	14	13	65	157	222	3	32 2½	—			—	3	—

* Also competing in Section VI. † Disqualified under Clause 24 (Eggs failed to reach standard weight of 24 ozs. per dozen).
‡ Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION II.—WHITE WYANDOTTE—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
*‡	62	Mrs. M. Byrne, Knockbutton, Windgap, Co. Kilkenny.	Feb.	367	4 0	—	13	27	19	19	19	29	3	—	—	—	—	—	97	32	129	52	23 4¾	—	8 8 4¾	(a) 1,063; lbs. ozs. dr. (b) 136 2 2; ozs. (c) 24·6	5/4/29	—	—
			,,	368	4 0	—	—	17	23	19	23	29	7	—	—	—	—	—	87	31	118	48	20 6¼	—			8/5/29	—	—
			,,	369	4 8	5 0	—	17	19	18	16	21	23	13	22	22	19	—	187	3	190	43	29 3	—			—	—	June
			,,	370	4 4	5 4	3	25	28	25	23	29	25	28	18	24	24	11	233	30	263	65	41 0¾	—			—	—	June
			,,	371	4 4	—	4	26	24	18	21	25	23	17	1	—	—	—	135	24	159	50	26 4¼	—			2/8/29	—	May
			,,	372	4 4	4 8	10	14	10	21	18	25	27	17	22	19	9	12	89	115	204	31	27 9¾	—			—	3	June
‡	21	Miss E. M. Harman, Crossdrum, Oldcastle, Co. Meath.	25/3/28	121	4 8	5 4	10	23	23	23	19	22	26	11	13	18	19	3	151	59	210	40	32 6¾	2	8 3 4¾	(a) 1,079; lbs. ozs. dr. (b) 135 8 8; ozs. (c) 24·1	—	3	Aug.
			,,	122	5 0	6 2	9	26	27	25	5	26	27	21	18	2	21	4	132	79	211	22	32 2¼	—			—	4	July
			9/3/28	123	4 12	5 4	9	27	27	28	25	16	24	19	14	12	10	14	64	161	225	30	32 11¼	—			—	5	June & July
			,,	124	5 0	7 12	—	7	4	—	—	—	—	—	—	—	—	—	10	1	11	10	2 7¾	—			—	—	—
			,,	125	5 0	6 4	1	24	24	24	22	23	22	12	15	13	10	10	122	78	200	25	30 5¾	—			—	3	July
			,,	126	5 8	7 2	—	12	17	20	23	27	26	25	22	19	23	6	211	9	220	32	32 4¾	—			—	—	—
‡	24	Mrs. L. Ross, Liscarney, Monaghan.	18/3/28	139	4 8	5 0	14	25	23	22	21	22	25	24	20	20	22	11	87	162	249	39	35 5½	—	8 3 3	(a) 1,187; lbs. ozs. dr. (b) 150 6 5; ozs. (c) 24·3	—	—	—
			,,	140	4 12	5 4	—	—	4	20	18	22	12	19	11	14	13	—	18	115	133	—	16 0	—			—	4	Oct.
			,,	141	4 8	—	—	—	—	—	15	26	27	25	14	1	—	—	—	108	108	—	10 5¼	—			4/8/29	—	Oct.
			,,	142	4 8	6 12	—	—	14	7	21	26	25	25	24	23	23	11	196	3	199	19	27 5¾	—			—	—	Nov. & Aug.
			,,	143	4 0	5 4	1	23	26	20	7	28	28	24	27	26	27	11	239	9	248	54	38 0¼	—			—	—	—
			,,	144	4 8	6 12	13	21	22	21	19	22	25	24	24	24	24	11	141	109	250	2	35 10¼	—			—	—	June
*†‡	68	Mrs. N. Egan, Liscam House, Athlone, Co. Roscommon.	March	403	4 8	5 4	—	11	17	17	15	20	21	23	20	6	20	11	157	24	181	21	26 8	—	8 0 5½	(a) 1,103; lbs. ozs. dr. (b) 132 1 12; ozs. (c) 23·0	—	1	July
			,,	404	4 0	4 12	—	16	25	21	22	26	11	19	13	19	8	13	—	193	193	—	25 9	—			—	—	—
			,,	405	4 4	5 12	15	23	27	23	18	22	19	18	8	2	12	—	95	92	187	11	28 11¾	—			—	—	Sept.
			,,	406	4 12	6 0	9	29	25	26	21	20	25	16	18	18	8	—	101	114	215	8	31 11	—			—	—	Sept.
			,,	407	4 4	—	9	24	21	25	21	25	22	1	—	—	—	—	59	89	148	24	23 6¾	—			5/5/29	—	—
			,,	408	4 0	5 0	—	23	22	6	7	22	23	18	18	16	17	7	18	161	179	1	23 7	—			—	—	Sept.
20*	59	Mrs. M. Nagle, Springmount, Mallow, Co. Cork.	26/2/28	349	4 8	3 8	9	17	25	22	22	21	17	19	15	11	—	—	62	116	178	30	25 11¼	3	7 17 6½	(a) 1,041; lbs. ozs. dr. (b) 138 9 4; ozs. (c) 25·6	—	3	June
			March	350	4 8	4 8	10	21	24	19	20	26	26	25	20	—	16	4	211	—	211	63	33 8½	—			—	—	June & Aug.
			,,	351	5 0	6 0	—	3	6	3	3	10	11	10	10	10	9	5	74	6	80	6	11 1¼	—			—	—	June
			,,	352	5 0	6 0	12	20	19	19	4	18	17	15	13	10	13	11	136	35	171	31	27 0¼	—			—	7	May
			,,	353	4 12	5 4	13	20	22	9	—	21	27	24	22	18	21	11	206	2	208	58	32 3	—			—	—	Jan.
			,,	354	4 12	5 0	—	—	13	24	21	25	26	25	9	23	13	11	178	12	190	22	27 1	—			—	2	June & Sept.

* Also competing in Section VI. † Disqualified under Clause 24 (Eggs failed to reach standard weight of 24 ozs. per dozen).
‡ Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION II.—WHITE WYANDOTTE—*continued.*

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	16th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade.	Total.	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet. s. d.	Untrapped Eggs.	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
‡§	28	Mrs. M. J. Williams, Milltown, Kilmacow, Co. Waterford.	March	163	4 0	5 8	14	24	28	23	19	19	6	—	—	—	—	—	132	1	133	76	25 6¾	—	7 16 9	(a) 1,010 lbs. ozs. dr. (b) 127 5 4 ozs. (c) 24·2	—	—	—
			,,	164	4 0	5 0	11	20	19	23	19	22	25	23	19	22	19	11	173	60	233	27	34 8¾	—			—	—	Sept.
			,,	165	4 8	4 8	12	23	20	21	22	25	23	24	19	11	22	2	30	194	224	7	30 3¾	—			—	2	Sept.
			,,	166	5 4	—	10	22	22	7	—	—	—	—	—	—	—	—	61	—	61	61	13 10½	—			14/1/29	—	—
			,,	167	4 0	5 12	—	6	25	27	24	25	27	9	20	9	16	13	143	58	201	12	29 4	—			—	2	Sept.
			,,	168	4 0	—	11	15	22	18	23	22	28	19	—	—	—	—	61	97	158	14	22 11¼	—			16/6/29	1	—
21*	73	Mrs. A. B. Barber, Knockbeg House, Collooney, Co. Sligo.	1/3/28	433	4 8	—	10	13	22	16	12	26	15	14	13	16	18	5	161	19	180	53	28 4	—	7 13 2¾	(a) 1,023 lbs. ozs. dr. (b) 132 15 12 ozs. (c) 25·0	12/9/29	5	Sept.
			,,	434	4 12	6 12	—	15	18	20	16	20	10	21	14	11	16	7	165	3	168	43	26 9¼	—			—	2	April.
			,,	435	5 0	5 4	7	19	10	4	21	21	14	19	9	10	21	2	123	34	157	30	23 7½	—			—	1	Sept.
			,,	436	4 8	4 8	2	8	24	25	24	24	23	24	20	24	20	10	174	54	228	26	33 1	—			—	—	Sept.
			,,	437	4 8	5 12	—	3	7	12	14	20	12	9	11	10	11	2	90	21	111	12	15 7¾	—			—	—	Sept.
			,,	438	4 8	4 4	—	13	20	8	10	24	24	20	22	21	13	4	152	27	179	29	25 9¼	—			—	—	Sept.
*§	71	Mrs. J. Spellman, Ardmore, Boyle, Co. Roscommon.	March	421	4 0	—	12	24	21	1	—	—	—	—	—	—	—	—	51	7	58	51	13 1¾	1	6 17 6¼	(a) 858 lbs. ozs. dr. (b) 120 2 14 ozs. (c) 26·9	7/3/29	—	—
			,,	422	4 4	5 0	—	—	9	22	19	23	23	22	16	23	21	10	185	3	188	20	26 8½	—			—	1	June & Oct.
			,,	423	4 4	—	—	6	—	—	—	—	—	—	—	—	—	—	4	2	6	4	1 5	—			2/12/28	—	—
			,,	424	4 4	4 4	8	24	25	21	18	22	22	23	22	21	19	10	235	—	235	66	37 6¾	—			—	—	Sept.
			,,	425	4 8	5 0	6	25	24	20	17	23	24	22	23	11	11	2	205	3	208	64	33 3½	—			—	—	Aug.
			,,	426	5 4	6 4	6	14	15	15	10	12	19	18	17	15	14	7	162	—	162	43	25 3	—			—	—	June
*‡§	72	Mrs. Hand, Berries Hill, Athlone.	March	427	4 8	—	4	17	1	—	—	—	—	—	—	—	—	—	6	16	22	6	4 7¼	2	6 5 7¾	(a) 881 lbs. ozs. dr. (b) 110 3 7 ozs. (c) 24·0	2/12/28	—	—
			,,	428	4 8	5 12	—	12	23	23	21	24	23	20	6	—	—	—	150	2	152	46	24 3¾	—			—	1	—
			,,	429	4 8	5 0	—	4	19	15	18	22	24	24	14	23	20	12	1	194	195	—	23 5¾	—			—	1	Nov. & Sept.
			,,	430	4 8	6 0	—	15	25	16	9	9	2	—	—	—	—	—	66	10	76	44	15 0¼	—			—	—	June
			,,	431	5 0	5 8	6	23	22	5	17	25	24	23	10	18	18	9	194	6	200	54	31 4½	—			—	1	—
			,,	432	4 0	4 8	—	—	5	26	24	28	29	29	22	29	28	14	1	233	234	—	26 7	—			—	—	—

* Also competing in Section VI.
‡ Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).
§ Disqualified under Clause 26 (Pen produced less than 1,020 eggs).

SECTION IV.—SITTING BREEDS—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Gadre.	No. of Second Grade	Total.	First Grade Eggs, 16th Oct. 15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
*‡	94	Light Sussex.	28/2/28	559	5 8	6 4	10	20	24	21	19	25	26	11	21	12	6	10	38	167	205	20	28 5¾	2		(a) 1,178	—	1	July
		Miss E. Walsh,	,,	560	5 8	6 12	1	10	18	21	22	24	18	21	15	14	21	15	155	45	200	19	29 5¼	—		lbs. ozs. dr.	—	5	—
		Ballylemon Lodge,	,,	561	5 0	6 0	—	—	6	16	16	20	18	7	22	17	21	—	140	3	143	14	20 0	—	8 19 6¼	(b) 152 10 9	—	1	—
		Cappagh,	,,	562	5 8	6 12	14	27	27	27	28	30	30	18	22	18	14	4	243	16	259	82	41 3¾	—		ozs.	—	1	—
		Co. Waterford.	,,	563	5 8	6 8	4	17	24	23	21	27	19	13	4	—	3	—	154	1	155	57	26 0½	—		(c) 24·9	—	1	Sept.
			,,	564	5 8	6 0	9	26	22	19	24	18	18	17	19	16	14	12	171	43	214	58	33 9¾	—			—	4	Sept.
10*	78	R.I.R.	March	463	4 8	5 12	6	25	23	22	19	27	27	27	24	21	26	11	247	11	258	60	40 1¾	—		(a) 1,150	—	—	Sept.
		Mrs. A. L. Hurley,	27/2/28	464	5 8	5 0	5	23	21	22	3	21	21	25	14	9	15	1	178	2	180	60	29 2¼	—		lbs. ozs. dr.	—	2	—
		Cloncorban,	,,	465	4 12	—	—	—	11	20	9	17	25	25	25	23	20	—	83	92	175	17	22 0¼	—	8 19 2	(b) 154 5 13	30/8/29	—	—
		Ballineen,	,,	466	5 0	6 4	9	27	18	12	4	16	17	13	8	2	2	3	104	27	131	52	22 1	—		ozs.	—	—	Sept.
		Co. Cork.	,,	467	5 0	5 4	6	21	22	15	3	21	23	23	21	16	3	10	182	2	184	55	28 11½	—		(c) 25·8	—	—	Sept.
			,,	468	4 8	6 4	14	25	26	24	21	25	18	11	21	16	10	11	218	4	222	76	36 9¼	—			—	—	July
‡	38	R.I.R.	7/3/28	223	4 8	5 8	—	17	25	19	—	29	13	15	15	13	4	13	154	9	163	50	26 4¼	1		(a) 1,150	—	5	Aug.
		Mrs. J. A. Donegan,	28/2/28	224	4 0	5 0	12	24	25	24	23	28	23	10	18	11	15	10	111	112	223	41	33 8¼	—		lbs. ozs. dr.	—	2	July
		Blakestown,	7/3/28	225	4 8	5 0	—	10	21	22	20	21	18	11	12	9	11	3	152	6	158	40	25 0	—	8 17 8	(b) 148 5 8	—	2	—
		Ardee,	28/2/28	226	4 8	5 4	13	12	—	8	22	26	28	26	17	15	11	8	171	15	186	18	26 0½	—		ozs.	—	1	Aug.
		Co. Louth.	,,	227	4 8	5 4	16	28	29	28	22	26	21	24	19	4	—	—	134	83	217	50	34 2	—		(c) 24·8	—	—	Aug. & Sept.
			,,	228	4 4	5 2	9	24	22	22	22	23	21	14	18	5	13	9	172	30	202	53	32 3½	—			—	1	July
		R.I.R.	21/1/28	229	5 0	5 0	—	15	26	25	24	28	26	19	18	10	23	2	203	13	216	54	33 6¾	1		(a) 1,160	—	4	June & July
11	39	Miss D. Strong,	29/2/28	230	5 0	7 12	—	13	23	22	20	27	23	27	23	24	19	2	222	1	223	47	33 9	—		lbs. ozs. dr.	—	—	Aug.
		Moate House,	24/2/28	231	5 0	6 4	—	6	—	4	20	25	23	19	16	7	18	1	132	7	139	6	18 6¼	—	8 17 2½	(b) 156 10 15	—	2	Nov.
		Kells,	29/2/28	232	4 12	5 8	4	10	6	14	5	18	26	15	14	19	13	12	147	9	156	25	22 6¾	—		ozs.	—	3	Aug.
		Co. Meath.	6/2/28	233	5 8	6 2	2	20	25	22	24	24	26	10	7	12	12	11	194	1	195	59	31 10¼	—		(c) 25·9	—	3	Aug. & May
			11/2/28	234	4 8	4 12	13	23	28	25	7	22	27	20	25	17	9	14	216	14	230	73	36 8¾	—			—	3	—
12	37	R.I.R.	7/3/28	217	4 4	5 4	8	27	26	22	20	25	25	19	21	17	23	2	231	4	235	72	37 10½	—		(a) 1,190	—	2	—
		Mrs. E. M. Dennehy,	,,	218	4 0	6 0	—	8	22	25	23	26	25	26	21	21	15	9	218	3	221	41	33 1	—		lbs. ozs. dr.	—	—	Aug.
		Ballymanus,	,,	219	4 4	6 0	—	1	17	15	10	18	20	26	17	16	22	10	125	41	166	14	23 0¼	—	8 16 4¼	(b) 161 0 15	—	—	—
		Stradbally,	,,	220	4 0	6 0	—	—	17	21	20	24	26	15	24	19	18	13	192	5	197	23	28 4	—		ozs.	—	1	Aug.
		Laoighis.	,,	221	4 0	5 8	—	6	18	23	19	23	21	22	21	7	15	8	180	3	183	35	27 5¼	—		(c) 26·0	—	1	July
			,,	222	4 0	6 0	—	11	14	19	21	24	12	17	19	18	20	13	106	82	188	16	26 7¼	—			—	5	—

* Also competing in Section VI.
‡ Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION IV.—SITTING BREEDS—*continued.*

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test. lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	16th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade.	Total.	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet. s. d.	Untrapped Eggs.	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
‡	35	R.I.R.	March	205	4 8	5 0	—	10	24	23	24	30	29	27	25	24	14	—	225	5	230	42	33 11¾	—		(a) 1,230	—	—	Sept.
		Miss J. Deady,	”	206	4 12	5 0	10	22	24	23	20	22	23	21	20	19	12	10	193	33	226	56	35 3	—		lbs. ozs. dr.	—	—	—
		Jerpoint Abbey,	”	207	4 8	4 12	—	3	22	24	17	25	23	20	22	12	10	12	62	128	190	16	25 2½	—	8 15 11¼	(b) 155 1 0	—	3	Sept.
		Thomastown,	”	208	4 8	4 4	7	17	6	8	21	29	29	28	24	21	5	—	66	129	195	1	24 4½	—		ozs.	—	—	Sept.
		Co. Kilkenny.	”	209	5 0	—	11	24	26	24	23	26	24	20	—	—	—	—	76	102	178	24	27 5	—		(c) 24·2	5/6/29	—	—
			”	210	5 0	5 12	—	13	19	22	16	22	22	27	18	24	16	12	128	83	211	18	29 8½	—			—	—	Sept.
*‡	82	R.I.R.	March	487	5 0	7 0	6	19	19	25	14	22	26	24	23	24	23	13	215	23	238	35	36 0¼	1		(a) 1,277	—	—	—
		Mrs. K. Sheehy,	”	488	5 0	6 0	11	24	25	24	9	26	28	30	28	25	27	11	24	244	268	1	35 1¾	—		lbs. ozs. dr.	—	—	Sept.
		Bridge House,	”	489	5 8	5 4	8	14	—	13	9	19	26	25	20	18	21	14	145	42	187	8	25 8¾	—	8 15 4	(b) 161 15 12	—	2	Sept.
		Ballingarry,	”	490	4 8	5 0	—	2	3	23	21	15	16	27	25	25	19	12	177	11	188	12	26 2½	—		ozs.	—	1	Nov.
		Co. Limerick.	”	491	4 8	5 12	12	20	21	22	19	16	26	22	25	15	21	11	122	108	230	12	33 1¼	—		(c) 24·4	—	1	Sept.
			”	492	4 8	6 0	—	—	—	—	7	23	25	29	24	25	20	12	83	82	165	—	18 11	—			—	—	—
13	30	R.I.R.	Feb.	175	5 0	5 4	9	20	22	21	20	7	—	15	10	17	15	11	160	7	167	60	28 9¾	—		(a) 1,095	—	2	—
		Mr. D. V. O'Grady,	”	176	4 8	5 0	10	22	21	13	3	24	23	26	15	18	19	3	193	4	197	60	31 0½	—		lbs. ozs. dr.	—	3	—
		Minaville,	”	177	4 8	5 0	8	23	23	19	6	14	2	—	—	3	—	1	87	12	99	55	19 5	—	8 15 3¼	(b) 150 6 15	—	—	—
		Glanmire,	”	178	4 8	6 0	2	23	16	21	22	24	17	20	13	9	16	10	192	1	193	49	31 0¾	—		ozs.	—	2	—
		Co. Cork.	”	179	5 8	6 4	—	12	23	22	13	22	20	10	18	14	7	11	172	—	172	46	27 2½	—		(c) 26·4	—	2	Aug.
			”	180	4 4	4 12	11	27	23	22	19	27	26	26	22	28	23	13	105	162	267	25	37 8¾	—			—	—	Aug.
		R.I.R.	7/3/28	235	4 8	6 4	7	—	—	23	23	27	25	23	22	11	5	—	166	—	166	16	22 8¾	—		(a) 1,143	—	—	Nov. & Aug.
14	40	Miss M. Murray,	”	236	4 8	3 12	8	19	20	23	20	22	19	19	13	15	3	—	165	16	181	45	28 9½	—		lbs. ozs. dr.	—	—	Aug.
		Racecourse,	”	237	4 8	4 12	—	—	3	21	22	23	24	21	24	21	19	2	179	1	180	12	24 7¼	—	8 10 2½	(b) 155 1 9	—	—	Nov.
		Clones,	”	238	5 0	4 8	—	19	24	24	20	25	24	25	22	24	7	—	184	30	214	34	32 2½	—		ozs.	—	—	Aug.
		Co. Monaghan.	”	239	4 8	5 8	11	21	23	5	10	25	23	24	21	16	14	6	190	9	199	52	30 9	—		(c) 26·1	—	—	June
			”	240	4 8	4 8	—	11	21	23	20	23	22	26	13	19	15	10	202	1	203	42	31 1½	—			—	1	June
15*	91	Buff Rock.	28/2/28	541	4 8	6 8	—	14	18	22	21	24	24	24	23	24	21	11	226	—	226	42	34 1¾	—		(a) 1,059	—	—	—
		Mrs. M. Ffrench,	”	542	5 0	6 0	9	24	20	22	19	—	21	13	15	11	12	6	172	—	172	63	29 0¼	—		lbs. ozs. dr.	—	—	Sept.
		Poulfaille Cottage,	”	543	5 8	5 8	—	14	23	20	20	25	21	21	16	20	3	—	183	—	183	46	28 4¾	—	8 10 1¼	(b) 155 1 13	—	—	Aug.
		New Ross,	”	544	4 8	6 4	—	15	18	10	18	17	13	19	5	5	5	—	125	—	125	33	20 4¼	—		ozs.	—	—	Sept.
		Co. Wexford.	”	545	5 0	—	11	24	21	24	18	20	24	25	16	12	4	—	199	—	199	68	32 3	—		(c) 28·1	10/9/29	—	Sept.
			”	546	5 0	6 8	—	24	22	19	18	23	23	3	6	13	—	3	153	1	154	55	25 11¼	—			—	—	Sept.

* Also competing in Section VI.
‡ Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION IV.—SITTING BREEDS—*continued*.

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	16th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade.	Total.	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet. s. d.	Untrapped Eggs.	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
16‡	89	Buff Rock.	Feb. or March	529	5 8	6 8	6	17	19	22	18	24	24	21	19	16	12	8	199	7	206	52	31 10¾	1		(a) 1,143	—	—	Sept.
		Mrs. L. Mounsey,	,,	530	5 8	5 12	—	—	10	18	9	21	20	9	25	9	24	10	154	1	155	20	22 1¾	—		lbs. ozs. dr.	—	1	Sept.
		Beech Hill,	,,	531	5 0	6 8	—	22	22	21	20	21	25	17	19	7	13	11	198	—	198	54	31 7½	—	8 8 10½	(b) 163 11 11	—	1	July
		Ballyduff,	,,	532	5 4	6 8	—	—	—	22	22	25	28	22	13	19	22	11	184	—	184	11	25 3¼	—		ozs.	—	—	Nov.
		Tullamore,	,,	533	5 8	6 8	—	14	25	25	17	29	24	22	11	23	20	10	218	2	220	50	34 3¾	—		(c) 27·5	—	1	June
		Offaly.	,,	534	4 8	5 8	—	2	1	—	20	28	24	26	22	25	21	10	178	1	179	3	23 4¾	—			—	1	Nov.
17	106	R.I.R.	March	615	4 8	6 12	—	16	22	23	22	25	27	27	23	23	21	10	236	3	239	47	36 3¼	—		(a) 1,068	—	—	—
		Mrs. M. E. King,	,,	616	5 0	—	—	21	17	—	—	—	—	—	—	—	—	—	11	27	38	11	8 1¼	—		lbs. ozs. dr.	5/1/29	—	—
		Beechgrove,	,,	617	4 8	5 0	—	28	13	—	23	28	29	28	23	22	21	10	209	16	225	34	32 11¾	—	8 7 10¾	(b) 142 1 1	—	—	—
		Donadea,	,,	618	4 8	5 8	—	14	16	16	14	16	16	11	6	9	5	—	115	8	123	34	19 9¼	—		ozs.	—	—	—
		Co. Kildare.	,,	619	5 0	5 12	—	23	25	27	24	25	21	19	11	15	19	5	199	15	214	51	34 4¼	—		(c) 25·5	—	—	June
			,,	620	4 8	5 8	—	23	29	28	24	30	30	25	13	17	—	10	227	2	229	64	36 5	—			—	—	Aug.
*†‡	92	Barred Rock.	21/4/28	547	4 8	6 0	3	15	19	14	16	21	20	21	16	19	15	7	59	127	186	2	25 2	—		(a) 1,226	—	—	Sept.
		Mrs. B. Power,	,,	548	4 8	6 8	—	—	8	8	21	27	13	18	16	11	3	14	40	99	139	—	16 11¾	—		lbs. ozs. dr.	—	5	—
		Slieverue,	,,	549	5 0	5 4	11	12	4	22	24	26	25	26	23	25	20	14	25	207	232	—	28 7¼	—	8 6 5¾	(b) 148 11 3	—	1	—
		Butlerstown,	,,	550	5 8	—	9	22	25	23	22	30	28	24	8	6	—	—	181	16	197	56	31 5½	—			28/8/29	1	June & July
		Co. Waterford.	,,	551	4 8	5 12	—	—	—	21	20	26	26	27	25	27	27	13	174	38	212	3	27 10¼	—		ozs. (c) 23·3	—	—	—
			,,	552	4 12	5 12	7	28	30	28	26	30	24	17	22	18	14	16	48	212	260	1	36 5	—			—	3	—
18	31	R.I.R.	Feb.	181	5 8	3 12	12	1	5	16	18	25	26	27	25	23	21	3	201	1	202	24	28 1	—		(a) 1,127	—	—	—
		Mrs. C. O'Shea,	,,	182	5 0	5 0	13	26	25	26	25	30	27	25	23	20	12	—	249	3	252	74	40 0¾	—		lbs. ozs. dr.	—	—	Aug.
		Codrum,	,,	183	5 8	5 0	10	22	24	26	25	28	28	22	9	13	—	1	134	74	208	34	31 5	—	8 6 4½	(b) 157 0 2	—	1	—
		Macroom,	,,	184	6 0	5 8	—	—	—	—	5	17	19	17	—	—	4	3	65	—	65	—	7 11½	—		ozs.	—	1	Nov.
		Co. Cork.	,,	185	5 0	4 8	7	14	—	—	14	27	29	29	23	26	17	—	185	1	186	21	25 4½	—		(c) 26·7	—	—	Aug. & Nov.
			March	186	5 4	6 0	8	26	21	6	15	27	24	23	23	15	20	6	214	—	214	61	33 5¾	—			—	3	—
*‡	79	R.I.R.	14/3/28	469	4 8	5 4	1	20	24	21	5	14	15	20	20	5	—	11	149	7	156	52	25 7¼	—		(a) 1,117	—	2	Sept.
		Miss K. Morrissey,	,,	470	4 0	4 4	3	24	27	23	20	24	27	18	15	20	18	1	76	144	220	27	31 6¾	—		lbs. ozs. dr.	—	3	Sept.
		Jamestown,	,,	471	4 12	6 0	—	—	9	23	22	21	18	19	15	16	15	7	61	104	165	1	21 1¼	—	8 6 1	(b) 146 13 13	—	5	—
		Pitown,	,,	472	4 8	5 8	—	17	21	17	16	21	22	22	19	21	17	7	196	4	200	46	30 9¾	—		ozs.	—	—	Sept.
		Co. Kilkenny.	,,	473	4 12	5 4	13	13	21	20	7	22	23	17	16	14	16	12	151	43	194	38	29 5	—		(c) 25·2	—	5	—
			,,	474	4 8	5 12	—	7	20	23	21	20	22	22	14	18	15	—	180	2	182	39	27 7	—			—	1	Sept.

‡ Also competing in Section VI. † Disqualified under Clause 24 (eggs failed to reach standard weight of 24 ozs. per dozen).
* Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade.	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
19‡	93	Barred Rock.	16/3/28	553	5 4	6 0	6	21	23	21	20	28	27	19	2	5	—	10	175	7	182	56	29 7¼	—		(a) 1,042	—	1	—
		Mrs. E. A. Henderson	22/3/28	554	5 0	5 4	8	16	18	10	5	11	7	18	1	—	—	1	80	15	95	42	16 6	—		lbs. ozs. dr.	—	—	July &Sept.
		Ardrum, Inniscarra,	"	555	5 4	6 12	3	15	23	19	18	28	29	25	12	19	16	6	205	8	213	52	32 6¼	—	8 2 6½	(b) 141 4 7	—	1	—
		Co. Cork.	16/3/28	556	5 0	7 0	8	18	4	22	19	25	24	25	23	22	19	3	143	69	212	23	29 7½	—		ozs.	—	—	Sept.
			22/3/28	557	4 12	—	5	3	20	18	17	22	18	—	—	—	—	—	95	8	103	29	16 9¾	—		(c) 26·0	1/5/29	—	—
			16/3/28	558	5 8	6 8	9	24	21	18	21	25	27	23	16	18	23	12	237	—	237	63	37 5¾	—			—	—	—
§‡	81	R.I.R.	March	481	4 8	6 0	—	22	25	22	24	24	25	23	18	19	10	9	229	1	230	57	36 3½	—		(a) 957	—	—	—
		Miss E. M. Scanlan,	"	482	4 8	6 0	—	9	13	18	16	2	27	22	17	22	16	3	165	—	165	30	24 4¼	—		lbs. ozs. dr.	—	1	—
		Ballyduhig House,	"	483	4 12	—	6	20	22	7	—	—	—	—	—	—	—	—	1	54	55	1	10 8	—	7 5 5½	(b) 136 15 7	11/4/29	—	—
		Ballagh,	"	484	4 8	5 8	2	19	—	7	19	23	22	23	22	23	25	10	183	12	195	18	27 10½	—		ozs.	—	—	Sept.
		Charleville.	"	485	4 12	6 0	—	—	15	—	22	24	24	21	19	17	3	13	156	2	158	14	21 7½	—		(c) 27·6	—	2	June
			"	486	4 4	5 4	5	16	13	20	21	19	20	14	10	—	6	10	152	2	154	44	24 8	—			—	1	July
§‡	85	Buff Rock.	6/3/28	505	4 8	5 4	—	17	23	23	22	27	24	11	23	18	11	15	183	31	214	39	32 8¼	—		(a) 901	—	2	Sept.
		Mrs. N. Ryan,	"	506	5 0	6 0	10	19	20	19	18	25	24	22	12	23	9	11	210	2	212	57	33 5	—		lbs. ozs. dr.	—	1	Sept.
		Cluggin House, Oola,	"	507	4 8	5 0	10	14	4	—	18	25	21	17	13	15	19	—	107	40	156	15	21 5¼	—	6 18 8	(b) 118 3 7	—	4	Jan. & Sept.
		Co. Limerick.	"	508	4 8	5 0	11	20	23	21	18	23	22	26	9	25	19	12	195	34	229	56	35 8¾	—		ozs.	—	1	—
			"	509	4 0	5 4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		(c) 25·2	—	2	Jan.
			"	510	4 8	—	3	—	24	22	23	18	—	—	—	—	—	—	58	32	90	27	15 4¾	—			3/4/29	—	—
§	33	R.I.R.	Feb.	193	5 0	6 12	3	21	27	29	19	26	24	25	22	14	16	10	222	14	236	64	37 2¼	1		(a) 865	—	1	Sept.
		Mr. E. A. Poulter,	"	194	4 8	6 4	—	7	10	13	22	28	25	14	14	14	12	9	142	26	168	16	23 8½	—		lbs. ozs. dr.	—	3	Sept.
		St. Brigid's,	"	195	4 8	6 8	—	5	26	25	20	23	21	20	20	17	18	8	198	5	203	43	30 11½	—	6 16 11¾	(b) 114 12 2	—	—	Sept.
		Roebuck,	"	196	5 0	5 0	12	26	22	25	23	24	21	8	—	—	—	—	97	64	161	46	26 5¾	—		ozs.	—	—	—
		Clonskea,	"	197	4 4	—	8	13	18	11	—	—	—	—	—	—	—	—	1	49	50	1	9 5	—		(c) 25·5	26/3/29	—	—
		Dublin.	"	198	5 8	—	—	—	14	23	9	—	—	—	—	—	—	—	46	—	46	25	9 0½	—			15/2/29	—	—
†§*	41	R.I.R.	March or April	241	4 0	5 8	1	26	24	21	19	24	22	9	—	2	6	6	66	94	160	15	24 9½	—		(a) 876	—	—	June
		Mrs. M. Shiel-Walsh,	"	242	4 4	6 0	1	16	19	18	19	17	—	—	—	—	2	1	81	12	93	32	17 2¾	—		lbs. ozs. dr.	—	—	Aug.
		Moneyvroe,	"	243	4 4	6 8	—	11	17	18	19	24	18	4	—	—	—	—	1	110	111	1	15 4¾	—	6 15 7¾	(b) 108 0 15	—	—	Aug.
		Cappoquin,	"	244	4 0	5 4	—	22	14	17	26	30	18	19	13	10	12	1	48	134	182	17	25 2¼	—		ozs.	—	4	July
		Co. Waterford.	"	245	4 0	4 8	4	25	22	20	18	21	16	—	—	—	—	—	125	1	126	60	23 0½	—		(c) 23·7	—	—	—
			"	246	4 0	5 4	—	16	24	23	19	22	25	20	11	19	17	8	129	75	204	20	30 0	—			—	2	June

‡ Also competing in Section VI. † Disqualified under Clause 24 (eggs failed to reach standard weight of 24 ozs. per dozen).
* Disqualified under Clause 26 (more than 20 per cent. second-grade eggs). § Disqualified under Cause 26 (pen producing less than 1,020 eggs).

SECTION IV.—SITTING BREEDS—*continued*.

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At Close of Test lb. oz.	16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	No. of First Grade	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
§	32	R.I.R. Mr. T. J. Maguire,	Feb.	187	4 0	5 4	—	15	21	15	18	20	21	23	20	20	15	3	89	102	191	10	26 4¼	—		(a) 953	—	—	Aug.
		Clara Villa,	,,	188	5 8	5 2	—	9	24	7	—	14	12	17	17	13	9	6	115	13	128	37	19 8¼	—		lbs. ozs. dr.	—	5	Aug.
		Claremont Rd.,	,,	189	4 8	5 8	—	—	4	17	22	28	26	23	13	18	4	—	139	16	155	9	20 6½	—	6 13 7	(b) 125 2 4	—	2	Nov.
		Sandymount,	,,	190	4 8	6 0	—	—	1	9	—	15	20	25	19	16	17	7	128	1	129	6	16 9¼	—		ozs.	—	—	Nov. & Aug.
		Dublin.	,,	191	5 0	5 12	—	22	23	23	20	22	21	15	8	11	11	—	122	54	176	24	27 3¾	—		(c) 25·2	—	2	Sept.
			,,	192	4 4	5 0	—	—	—	9	21	25	25	23	22	22	18	9	174	—	174	—	22 11	—			—	—	Sept.
§	44	Australorp. Mrs. S. J. Gabbett,	April	259	4 8	5 8	—	—	3	13	8	18	22	22	23	21	17	11	144	14	158	4	20 10	—		(a) 980	—	—	Aug.
		Ballaghtobin,	,,	260	5 8	6 0	—	—	10	24	20	27	25	26	23	24	25	8	211	1	212	21	29 10½	—		lbs. ozs. dr.	—	—	—
		Callan,	,,	261	5 8	7 0	—	—	—	18	16	18	20	17	22	8	20	8	145	2	147	2	20 0¼	—	6 9 5½	(b) 133 8 14	—	4	Nov. & Aug.
		Co. Kilkenny.	,,	262	5 8	6 8	—	—	—	5	7	17	17	26	14	22	9	13	101	29	130	2	16 2½	—		ozs.	—	1	Nov. & Aug.
			,,	263	5 8	5 8	—	—	8	4	9	21	28	24	14	23	19	13	160	3	163	8	21 9½	—		(c) 26·2	—	1	Nov.
			,,	264	5 8	6 12	—	—	5	8	8	14	26	26	22	24	25	12	95	75	170	1	20 8¾	—			—	—	Nov. & Aug.
‡§	95	Light Sussex. Miss M. Johnston,	Feb.	565	5 8	7 4	—	—	7	26	26	16	14	17	11	14	6	4	107	34	141	13	19 9¾	—		(a) 821	—	5	Sept. & Oct.
		Seaview, Murrinstown,	,,	566	5 0	7 8	—	—	—	15	20	18	18	11	16	12	11	4	121	4	125	3	17 0	—		lbs. ozs. dr.	—	5	Oct. & Sept.
		Co. Wexford.	,,	567	5 8	7 4	—	—	—	22	17	22	19	14	14	14	12	1	126	9	135	9	18 5¼	—	5 14 7¾	(b) 112 13 2	—	3	Sept. & Oct.
			,,	568	5 8	7 4	—	—	—	9	18	24	21	15	13	12	7	3	122	—	122	—	16 0½	—		ozs.	—	2	Sept.
			,,	569	5 8	5 8	—	2	22	26	23	27	9	19	15	13	12	5	169	4	173	36	26 8½	—		(c) 26·4	—	4	Sept.
			,,	570	5 0	—	—	—	12	19	16	20	18	16	13	11	—	—	71	54	125	5	16 7¼	—			19/8/29	2	Oct.
‡§	90	Buff Rock. Miss M. Dempsey,	Feb.	535	5 0	—	1	7	2	—	—	—	—	—	—	—	—	—	9	1	10	9	2 4¾	—		(a) 469	15/1/29	—	—
		Movilla,	,,	536	4 8	—	—	—	—	11	12	2	—	—	—	—	—	—	25	—	25	3	4 2½	—		lbs. ozs. dr.	1/6/29	—	—
		Oulart,	,,	537	4 12	4 8	—	—	—	—	—	11	23	17	15	10	—	—	75	1	76	—	8 7¾	—	3 11 1¾	(b) 64 1 0	—	—	Aug.
		Gorey,	,,	538	5 0	4 12	—	—	16	24	21	26	28	20	12	11	16	8	104	78	182	26	25 7¾	—		ozs.	—	4	—
		Co. Wexford.	,,	539	4 8	—	—	—	12	19	9	7	—	—	—	—	—	—	45	2	47	17	8 8½	—		(c) 26·2	7/5/29	—	—
			,,	540	5 0	—	4	18	17	19	16	19	11	15	10	—	—	—	122	7	129	45	21 6½	—			5/9/29	3	—

‡ Also competing in Section VI. §Disqualified under Clause 26 (pen producing less than 1,020 eggs).

SECTION V.—NON-SITTING BREEDS (STATION HOLDERS).

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Gradre.	No. of Second Grade	Total.	First Grade Eggs, 16th Oct. 15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
1‡	50	White Leghorn. Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	March]	295	3 8	4 12	—	21	24	22	22	24	26	26	25	23	25	8	239	7	246	55	37 10½	—	9 10 5½	(a) 1,268	—	—	—
			”	296	3 8	5 0	—	2	17	19	21	25	20	24	23	20	19	9	186	13	199	26	28 6½	—		lbs. ozs. dr. (b) 169 2 11	—	—	—
			”	297	3 8	5 2	1	18	24	17	21	24	22	24	20	9	2	8	183	7	190	44	29 7	—			—	—	June & Sept.
			”	298	3 8	4 8	8	24	23	5	18	22	24	27	23	27	23	14	223	15	238	50	36 4¼	—		ozs.	—	—	Sept.
			”	299	3 8	4 4	10	20	18	3	18	23	26	25	27	22	13	—	192	13	205	47	30 5¼	—		(c) 25·6	—	—	July
			”	300	3 4	4 8	—	23	18	19	17	19	18	20	18	17	15	6	94	96	190	31	27 8	—			—	—	Sept.
2‡	49	White Leghorn. Mrs. Mulcahy, Ballinahown, Ardagh, Limerick.	12/3/28	289	3 8	3 12	—	21	23	23	23	25	26	24	21	22	17	4	202	27	229	30	34 8¼	—	9 1 2	(a) 1,225	—	—	Aug.
			”	290	3 8	4 8	—	7	22	22	20	24	26	20	—	3	—	—	63	79	142	18	19 11	—		lbs. ozs. dr.	—	—	—
			”	291	3 8	4 0	4	19	20	2	7	27	28	23	26	23	23	13	180	35	215	16	30 10½	—		(b) 163 11 2	—	—	Jan.
			”	292	3 12	4 4	6	23	23	23	22	26	27	25	22	18	22	10	239	8	247	57	38 6¼	—		ozs.	—	—	Sept.
			”	293	4 4	4 8	2	21	23	2	3	29	29	29	25	25	25	11	220	4	224	46	33 3¾	—		(c) 25·7	—	—	Jan.
			”	294	3 8	3 8	—	9	18	19	16	21	23	24	19	16	3	—	126	42	168	24	23 10¼	—			—	—	Aug.
3‡	51	White Leghorn. Mrs. M. E. Higgins, Carramarla Lodge, Claremorris, Co. Mayo.	4/3/28	301	3 0	4 0	4	22	22	21	20	24	25	26	23	27	25	11	250	—	250	57	38 10	—	8 17 11½	(a) 1,163	—	—	June
			”	302	3 0	3 8	—	13	24	22	4	20	24	17	3	17	20	11	173	2	175	47	27 11½	—		lbs. ozs. dr.	—	—	—
			”	303	3 8	4 8	—	19	18	—	15	23	19	19	17	7	19	13	154	15	169	37	25 9¼	—		(b) 163 5 9	—	—	June
			”	304	3 8	4 0	8	24	16	21	14	23	23	23	20	23	20	10	224	1	225	57	35 4¼	—		ozs.	—	—	June
			”	305	3 0	4 8	—	3	23	21	20	24	22	24	20	23	22	10	211	1	212	35	31 6	—		(c) 27·0	—	—	Sept.
			”	306	3 8	4 8	9	11	4	7	14	21	25	19	14	8	—	—	116	16	132	20	18 6½	—			—	—	—
4‡	57	White Leghorn. Mrs. S. Cormack, Ballykerin, Ballincurry Thurles, Co. Tipperary.	10/4/28	337	4 0	4 8	3	12	23	9	18	20	22	24	20	18	9	—	150	28	178	21	25 11¾	—	8 12 0	(a) 1,088	—	—	Sept.
			”	338	3 8	5 0	1	23	23	23	21	22	24	22	23	25	25	12	244	—	244	59	38 3¾	—		lbs. ozs. dr.	—	—	Sept.
			”	339	3 8	4 8	7	23	19	20	18	23	20	12	9	18	15	4	183	5	188	54	30 8	—		(b) 151 2 13	—	—	Sept.
			”	340	3 8	4 0	8	24	24	24	23	24	—	19	18	19	15	9	207	—	207	68	34 10½	—		ozs.	—	—	Sept.
			22/4/28	341	3 8	4 8	2	23	23	24	22	25	25	28	27	25	27	11	254	8	262	57	40 4½	—		(c) 26·7	—	—	Sept.
			10/4/28	342	3 8	—	—	3	—	3	3	—	—	—	—	—	—	—	9	—	9	6	1 9½	—			18/5/29	—	—
5‡	46	White Leghorn. Mrs. M. McFadden, Towney, Kilcar, Co. Donegal.	8/4/28	271	3 4	3 8	1	23	19	19	19	21	22	22	21	22	22	3	201	13	214	41	33 0½	—	8 11 5	(a) 1,116	—	—	Sept.
			”	272	3 4	4 4	—	22	7	19	24	24	23	23	19	17	18	—	180	16	196	37	29 3	—		lbs. ozs. dr.	—	—	Sept.
			28/3/28	273	3 0	—	3	20	20	20	21	22	18	—	—	—	—	—	55	69	124	10	19 9	—		(b) 154 6 5	7/5/29	—	—
			”	274	3 0	4 4	1	25	5	18	19	20	22	26	24	23	24	10	217	—	217	37	32 10	—		ozs.	—	—	Sept.
			8/4/28	275	3 8	4 8	—	4	13	19	17	18	11	7	11	10	8	7	122	3	125	24	19 4	—		(c) 26·6	—	—	Sept.
			28/3/28	276	3 8	4 4	—	20	22	25	22	26	24	24	24	22	22	9	240	—	240	54	37 2½	—			—	—	Sept.

‡ Also competing in Section I.

SECTION V.—NON-SITTING BREEDS (STATION HOLDERS)—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
*‡	55	White Leghorn.	10/4/28	325	3 8	4 4	—	20	22	21	19	21	23	26	22	23	23	11	221	10	231	48	35 6¼	1		(a) 1,219	—	—	Sept.
		Mrs. B. O'Brien,	,,	326	4 0	6 4*	—	—	—	15	20	28	28	26	22	29	27	12	205	2	207	1	27 7¾	—		lbs. ozs. dr.	—	—	July
		Philipstown Cott.,	,,	327	3 8	4 0	7	22	22	22	20	27	25	28	24	17	—	—	170	44	214	52	32 3½	—	8 10 11½	(b) 161 0 4	—	—	July
		Cappawhite,	,,	328	4 0	4 8	—	—	2	24	24	24	27	22	19	20	21	3	112	74	186	10	23 8¼	—		ozs.	—	—	June
		Co. Tipperary.	,,	329	4 4	3 8	3	5	—	9	20	26	27	27	20	24	20	3	53	131	184	4	21 5	—		(c) 25·4	—	—	June
			,,	330	3 8	4 0	4	13	22	18	20	19	19	21	19	20	19	2	189	7	196	41	30 2	—			—	—	Sept.
6‡	56	White Leghorn.	27/3/28	331	4 8	4 0	8	21	22	22	19	25	24	24	24	17	17	2	218	7	225	56	35 1½	—		(a) 1,029	—	—	—
		Miss M. E. Anglim,	,,	332	3 8	3 2	11	21	20	2	15	23	22	23	24	19	20	—	153	47	200	25	29 2¾	—		lbs. ozs. dr.	—	—	—
		Farranaleen,	,,	333	3 8	—	—	11	15	11	—	—	—	—	—	—	—	—	14	23	37	14	7 5¾	—	8 1 0	(b) 138 4 7	19/1/29	—	—
		Fethard,	30/3/28	334	4 0	3 12	8	23	21	18	19	23	22	21	19	22	20	2	216	2	218	59	34 6	—		ozs.	—	—	Sept.
		Co. Tipperary.	,,	335	4 0	4 0	9	16	13	2	—	13	11	16	11	11	2	1	103	2	105	38	16 10¼	—		(c) 25·8	—	—	Sept.
			,,	336	3 8	4 0	12	20	22	16	19	22	25	26	25	24	23	10	243	1	244	62	37 9¾	—			—	—	—
7‡	53	White Leghorn.	April	313	3 4	—	11	25	26	21	21	24	19	3	—	—	—	—	126	24	150	49	26 1½	2		(a) 1,048	12/7/29	—	—
		Miss K. Martin,	,,	314	3 4	3 12	1	24	22	18	19	24	26	27	25	28	25	8	245	2	247	56	37 11¾	—		lbs. ozs. dr.	—	—	Sept.
		The Mountain,	,,	315	3 0	4 0	—	7	2	22	18	23	25	24	21	22	22	10	189	7	196	17	27 6¼	—	7 17 8½	(b) 141 6 12	—	—	June
		St. John's,	,,	316	3 8	3 8	—	16	19	22	23	22	18	1	—	—	—	—	29	92	121	19	18 4½	—		ozs.	—	—	—
		Knockcroghery,	,,	317	3 0	4 0	—	8	23	19	13	21	23	24	15	17	13	8	179	5	184	38	27 9¼	—		(c) 25·9	—	—	—
		Co. Roscommon.	,,	318	3 0	3 12	—	—	8	12	—	19	24	25	24	22	14	—	146	2	148	17	19 7½	—			—	—	Sept.
8‡	54	White Leghorn. Mrs. M. Cryan, Seefin,	10/3/28	319	4 8	4 4	—	—	—	—	9	4	—	5	7	5	—	—	9	21	30	—	3 5	1		(a) 1,047	—	—	June & Sept.
		Cloonloo,	,,	320	3 8	2 8	—	11	10	—	4	21	24	24	17	20	4	—	135	—	135	21	18 8¾	—		lbs. ozs. dr.	—	—	June
		Boyle,	,,	321	3 0	4 0	—	21	25	22	22	20	23	20	19	17	18	6	211	2	213	55	33 10½	—	7 16 1	(b) 142 11 3	—	—	Sept.
		Co. Roscommon.	,,	322	3 8	4 12	—	17	23	23	21	23	26	27	24	22	23	11	168	72	240	45	34 10½	—		ozs.	—	—	Sept.
			,,	323	3 8	4 0	—	5	24	15	21	24	25	28	27	25	22	7	207	16	223	34	32 1¼	—		(c) 26·2	—	—	June
			,,	324	3 8	4 4	4	25	23	23	20	25	23	22	18	15	7	—	205	—	205	63	33 0	—			—	—	Sept.
§‡	47	White Leghorn.	Feb.	277	3 8	3 12	11	23	22	10	21	26	25	28	24	24	15	5	213	30	243	63	37 1¼	—		(a) 1,009	—	—	—
		Mrs. M. McMahon,	,,	278	3 0	4 0	8	17	15	2	18	26	24	26	18	15	—	10	172	7	179	36	26 6½	—		lbs. ozs. dr.	—	—	—
		Gaybrook,	,,	279	3 12	4 0	7	16	25	21	22	27	21	13	—	7	—	—	142	17	159	49	26 0¾	—	7 13 0¼	(b) 138 5 7	—	—	—
		Malahide,	—	280	3 0	4 0	—	—	16	24	21	23	24	24	21	22	21	3	196	3	199	24	28 6¾	—		ozs.	—	—	Sept.
		Co. Dublin.	,,	281	3 4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		(c) 26·3	21/2/29	—	—
			,,	282	4 8	4 8	—	13	23	21	19	26	26	20	23	25	22	11	229	—	229	45	34 9	—			—	—	—

‡ Also competing in Section I. * Disqualified under Clause 26 (more than 20% second-grade eggs). § Disqualified under Clause 26 (pen produced less than 1,020 eggs).

SECTION V.—NON-SITTING BREEDS (STATION HOLDERS)—*continued.*

Order of Merit.	No. of Pen.	Name and Address of Owner	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	No. of Eggs Laid. 16th October inclusive.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	16th Sept., inclusive.	Eggs per Pullet. No. of First Grade.	No. of Second Grade.	Total.	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet. s. d.	Untrapped Eggs.	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death.	No. of Times Broody.	Date of Moulting.
§	58	Black Minorca. Mrs. R. Cochrane, Tullyroe, Tremaine, Co. Roscommon.	March	343	3 8	4 4	10	21	22	21	18	22	4	—	—	—	—	—	109	9	118	59	22 1¾	1		(a) 880	—	—	—
			28/3/28	344	3 8	4 8	—	—	17	19	11	14	24	22	13	10	14	10	150	4	154	27	22 5½	—		lbs. ozs. dr.	—	3	—
			24/3/28	345	3 8	4 4	10	20	25	4	10	26	23	25	20	19	17	8	198	9	207	57	31 11¼	—	6 18 0	(b) 118 9 8	—	—	Sept.
			28/3/28	346	3 8	4 2	—	—	4	15	17	17	16	17	18	9	17	4	134	—	134	13	18 8¼	—		ozs.	—	1	—
			March	347	3 8	—	7	6	—	18	18	—	—	—	—	—	—	—	43	6	49	16	8 11¼	—		(c) 25·9	2/3/29	—	—
			24/3/28	348	3 4	4 0	10	24	17	16	19	23	25	22	25	20	4	12	213	4	217	52	33 8¾	—			—	—	Sept.
§‡	52	White Leghorn. Mrs. M. A. Walsh, Wardstown, Athboy, Co. Meath.	1/4/28	307	4 0	4 4	9	3	—	3	7	24	25	27	12	15	15	—	138	2	140	11	18 5½	1		(a) 904	—	—	—
			,,	308	3 0	—	5	14	10	—	—	—	—	—	—	—	—	—	20	9	29	20	6 5¼	—		lbs. ozs. dr.	10/3/29	—	—
			,,	309	3 12	4 4	7	20	20	12	15	21	24	22	24	23	17	8	182	31	213	22	31 8¼	—	6 11 9¾	(b) 124 5 9	—	—	Sept.
			,,	310	4 4	4 8	2	18	9	6	19	20	20	21	15	8	—	—	137	1	138	28	20 8½	—			—	—	June & Aug.
			,,	311	3 8	3 0	4	12	20	15	17	21	23	24	20	16	12	—	90	94	184	28	25 6	—		ozs. (c) 26·4	—	—	Aug.
			,,	312	3 4	4 0	—	1	21	18	16	23	24	24	22	21	23	6	199	—	199	32	28 10¾	—			—	—	Nov. & Sept.

‡ Also competing in Section I. § Disqualified under Clause 26 (pen produced less than 1,020 eggs).

SECTION VI.—SITTING BREEDS (STATION HOLDERS).

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
*¶	86	R.I.R.	3/3/28	511	4 8	5 12	5	24	24	21	24	21	21	16	20	21	13	8	215	3	218	59	35 0½	—		(a) 1,345	—	—	Sept.
		Mrs. B. Naughton,	,,	512	4 8	4 8	14	26	29	27	24	20	24	14	19	22	16	—	62	182	244	16	34 10	—		lbs. ozs. dr.	—	—	Sept.
		Larkfield House,	,,	513	4 0	5 8	4	22	21	20	21	24	21	24	20	21	18	9	39	186	225	3	30 1½	—	10 2 11½	(b) 175 1 10	—	—	—
		Athlone.	,,	514	5 0	5 0	13	26	27	23	21	24	25	26	25	24	16	—	248	2	250	76	39 10¾	—		ozs.	—	—	Sept.
			,,	515	4 8	4 8	3	26	24	26	20	28	26	25	18	21	15	—	225	7	232	62	36 7¾	—		(c) 25·0	—	—	Sept.
			,,	516	4 8	5 0	—	13	21	17	15	21	22	21	21	17	3	5	161	15	176	34	26 5	—			—	—	—
*‡	60	White Wyandotte.	28/2/28	355	5 0	5 4	12	19	21	21	18	26	27	29	26	25	24	12	258	2	260	60	39 11	—		(a) 1,329	—	—	Sept.
		Mrs. J. Lehane,	21/3/28	356	5 8	5 8	13	22	24	22	21	24	23	28	15	23	14	13	204	38	242	47	37 5½	—		lbs. ozs. dr.	—	2	Sept.
		Crossmahon,	17/3/28	357	4 8	5 8	10	26	23	22	16	23	9	9	2	—	—	—	32	109	141	2	22 4¼	—	10 1 10¾	(b) 170 14 1	—	—	—
		Lissarda,	,,	358	5 0	5 0	12	8	21	25	23	25	23	19	16	18	18	11	76	143	219	5	30 0½	—		ozs.	—	—	Sept.
		Co. Cork.	,,	359	5 8	5 4	13	25	27	23	19	14	20	20	15	20	15	5	214	2	216	75	35 9½	—		(c) 24·7	—	4	Sept.
			,,	360	5 0	5 0	7	23	26	21	20	26	25	24	26	15	26	12	147	104	251	5	36 4	—			—	1	Sept.
1‡	67	White Wyandotte.	26/3/28	397	5 8	5 12	3	17	19	8	17	20	23	21	19	19	14	3	180	3	183	42	27 10¼	—		(a) 1,288	—	—	Sept.
		Mrs. K. Mullen,	,,	398	4 8	5 4	—	24	25	25	19	25	26	23	24	23	23	12	246	6	252	58	30 3¾	—		lbs. ozs. dr.	—	—	Sept.
		Oristown,	,,	399	4 4	5 0	1	23	23	22	18	24	22	15	23	13	11	10	203	2	205	56	32 10¼	—	10 0 11½	(b) 174 0 4	—	2	Sept.
		Kells,	,,	400	4 4	5 0	—	21	22	7	23	30	15	18	17	15	16	15	189	10	199	39	31 1¼	—		ozs.	—	4	Sept.
		Co. Meath.	,,	401	4 0	5 0	10	20	24	23	22	24	22	19	16	21	20	6	165	62	227	32	34 6	—		(c) 25·9	—	—	—
			,,	402	4 8	5 0	11	23	25	22	18	21	24	24	19	15	16	4	208	14	222	56	35 6¾	—			—	—	—
2¶	77	R.I.R.	Feb.	457	5 8	5 12	13	26	30	25	24	29	29	26	16	15	26	4	261	2	263	80	42 6	2		(a) 1,255	—	3	June
		Mrs. M. Burton,	,,	458	4 8	6 0	5	26	26	18	21	13	17	16	16	12	15	8	164	29	193	55	31 5¼	—		lbs. ozs. dr.	—	8	—
		Mine Hill,	,,	459	4 8	5 8	—	22	28	27	22	27	28	12	14	21	10	—	204	7	211	60	33 9¾	—	10 0 10	(b) 171 11 7	—	2	June
		Millstreet,	March	460	5 0	6 0	—	—	—	10	2	18	25	17	13	12	11	8	112	4	116	—	14 11¼	—		ozs.	—	4	—
		Co. Cork.	,,	461	5 0	6 8	12	27	27	24	21	20	22	20	18	18	15	9	233	—	233	79	38 4¾	—		(c) 26·3	—	—	Sept.
			,,	462	5 8	6 0	15	27	29	29	22	24	24	22	16	11	11	7	235	2	237	84	39 3¾	—			—	1	—
3‡	65	White Wyandotte.	9/2/28	385	4 8	—	14	23	25	24	19	17	12	8	11	5	—	—	157	1	158	73	28 0	—		(a) 1,167	16/7/29	—	—
		Miss A. Donegan,	,,	386	5 0	—	5	20	23	22	17	18	15	13	11	13	11	4	172	—	172	58	28 9¼	—		lbs. ozs. dr.	15/9/29	—	Sept.
		Monasterboice,	,,	387	5 8	6 12	12	24	23	23	22	22	21	19	24	22	16	6	233	1	234	70	37 6¼	—	9 16 6¾	(b) 161 8 0	—	—	—
		Drogheda,	,,	388	4 8	6 0	14	22	28	21	21	23	23	12	12	19	14	13	225	1	226	74	37 2	—			—	3	June & Sept.
		Co. Louth.	,,	389	4 8	5 8	14	26	26	23	20	10	13	10	5	2	3	—	149	3	152	73	27 7¾	—		ozs.	—	—	Sept.
			,,	390	4 8	5 4	7	25	22	23	22	27	22	17	16	12	20	12	222	3	225	63	37 5½	—		(c) 26·6	—	2	—

‡ Also competing in Section II. ¶ Also competing in Section IV. * Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION VI.—SITTING BREEDS (STATION HOLDERS).

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade.	No. of Second Grade	Total.	First Grade Eggs, 16th Oct. 15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
*‡	61	White Wyandotte.	16/3/28	361	5 0	5 8	—	14	24	25	23	26	28	16	17	15	17	4	201	8	209	44	32 2¼	—		(a) 1,297	—	2	Sept.
		Miss J. O'Keeffe,	,,	362	4 8	4 4	11	23	22	22	21	22	24	24	26	25	22	2	242	2	244	64	38 3½	—		lbs. ozs. dr.	—	—	June
		Ballybooden,	,,	363	4 8	4 8	12	24	23	21	20	23	25	20	18	14	20	5	121	104	225	32	33 4¼	—	9 16 4	(b) 168 9 7	—	—	Sept.
		Knocktopher,	,,	364	4 12	5 0	11	19	18	9	—	19	19	18	17	21	19	2	132	40	172	40	26 0¾	—		ozs.	—	—	—
		Co. Kilkenny.	,,	365	4 8	4 2	8	23	23	20	20	22	25	24	21	21	25	4	218	18	236	49	36 7	—		25·0	—	—	—
			,,	366	5 0	—	6	27	27	26	18	27	27	17	23	12	1	—	55	156	211	6	29 10¼	—			16/8/29	—	—
4‡	75	White Wyandotte.	March.	445	5 0	5 12	10	24	26	23	23	24	26	25	22	17	18	3	241	—	241	72	38 5½	1		(a) 1,213	—	—	Sept.
		Miss E. O'Donohue,	,,	446	4 8	5 0	—	16	22	25	19	23	19	16	13	21	19	4	197	—	197	51	31 4¼	—		lbs. ozs. dr.	—	—	June
		Killeigh,	,,	447	4 8	4 4	—	22	26	24	19	7	21	21	15	14	4	10	182	1	183	59	30 1½	—	9 13 3¾	(b) 165 12 4	—	3	March
		Cahir,	,,	448	4 12	5 8	13	24	27	26	19	25	20	23	5	6	26	7	216	5	221	77	36 11½	—		ozs.	—	—	Sept.
		Co. Tipperary.	,,	449	4 0	—	—	13	23	23	18	20	24	19	—	—	—	—	25	115	140	4	20 1¼	—		(c) 26·2	29/5/29	—	—
			,,	450	4 8	4 12	8	20	24	23	24	26	24	23	15	17	10	16	212	18	230	56	36 1¼	—			—	3	June
5¶	83	R.I.R.	25/2/28	493	4 8	5 12	1	24	12	—	7	29	30	27	15	26	2	13	170	16	186	34	26 11¾	—		(a) 1,224	—	2	Sept.
		Mrs. E. Murphy,	,,	494	4 8	5 0	12	24	23	23	23	28	15	23	13	10	17	16	216	11	227	67	37 1¼	—		lbs. ozs. dr.	—	3	Sept.
		Johnstown,	,,	495	4 8	5 4	11	19	24	20	22	25	24	19	18	18	21	4	147	78	225	39	33 6½	—	9 7 9¼	(b) 161 14 5	—	3	—
		Riverstown,	,,	496	4 12	5 12	1	24	25	14	1	24	24	27	12	14	21	4	190	1	191	59	30 5½	—		ozs.	—	2	June
		Dundalk,	,,	497	4 8	4 12	4	25	9	7	22	19	24	17	15	14	5	14	105	70	175	31	25 4¼	—		(c) 25·4	—	4	—
		Co. Louth.	,,	498	4 4	5 0	11	24	26	22	23	23	25	21	21	7	13	4	175	45	220	48	34 4	—			—	—	—
6¶	84	R.I.R.	23/2/28	499	5 0	4 8	12	24	22	19	22	22	24	22	25	15	21	11	194	45	239	64	36 9½	—		(a) 1,184	—	—	—
		Miss C. Mealiff,	,,	500	5 0	5 8	8	17	13	2	12	21	20	21	15	12	6	—	146	1	147	40	22 4	—		lbs. ozs. dr.	—	1	—
		Ballinamona Ho.,	,,	501	5 8	6 0	6	18	17	15	15	21	22	20	17	7	2	—	160	—	160	49	25 2	—	9 5 5¾	(b) 163 11 9	—	—	Sept.
		Tullamore,	15/3/28	502	4 8	6 0	—	22	22	20	20	27	29	28	15	6	20	—	209	—	209	55	32 8	—		ozs.	—	3	July
		Offaly.	,,	503	5 8	—	9	24	26	23	23	29	22	20	23	19	5	—	217	6	223	66	35 8¼	—		(c) 26·5	11/8/29	1	—
			,,	504	4 8	4 12	11	20	22	18	18	22	20	16	17	17	15	10	194	12	206	62	32 10	—			—	—	Sept.
		White Wyandotte.	Feb.	439	5 4	5 4	—	21	23	21	15	25	28	26	21	21	27	2	229	1	230	54	35 5½	—		(a) 1,211	—	—	June
7‡	74	Miss H. Frewen,	March	440	4 12	6 4	—	—	—	—	5	17	22	15	11	4	4	4	81	1	82	—	9 10¾	—		lbs. ozs. dr.	—	—	Nov. & June
		Rossboy,	,,	441	4 0	5 0	—	1	23	19	21	23	22	18	19	10	16	4	169	7	176	27	26 0¼	—	9 4 11	(b) 166 7 6	—	—	Sept.
		Glen of Aherlow,	Feb.	442	5 0	5 12	4	22	24	23	21	26	23	28	17	28	25	13	254	—	254	62	39 10¾	—		ozs.	—	1	June
		Co. Tipperary.	,,	443	5 0	5 0	11	25	27	26	23	28	25	28	23	11	20	10	250	7	257	76	41 0¼	—		(c) 26·4	—	1	June & Sept.
			,,	444	4 8	6 0	2	8	28	29	27	6	26	18	11	15	17	5	190	22	212	51	32 7½	—			—	4	Sept.

‡ Also competing in Section II. ¶ Also competing in Section IV. * Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION VI.—SITTING BREEDS (STATION HOLDERS)—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade.	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
*†‡	66	White Wyandotte. Sr. M. Patrick, Technical School, Claremorris, Co. Mayo.	7/2/28	391	4 4	2 4	12	25	26	22	22	27	23	20	23	22	—	—	73	149	222	22	31 8	2	9 2 0	(a) 1,250 lbs. ozs. dr. (b) 154 0 1 ozs. (c) 23·7	—	—	—
			,,	392	4 8	5 4	—	20	25	26	21	27	23	22	14	12	14	5	25	184	209	4	28 4½	—			—	—	Sept.
			,,	393	4 8	5 0	13	28	27	26	23	24	23	20	20	10	22	9	120	125	245	14	36 7¾	—			—	1	—
			,,	394	4 8	4 12	5	—	—	—	17	27	12	26	11	19	15	11	82	61	143	3	17 7¼	—			—	2	—
			,,	395	4 8	5 8	13	28	27	25	25	27	25	11	13	15	17	7	128	105	233	20	35 5½	—			—	2	June
			,,	396	4 8	5 8	—	21	26	22	21	22	12	24	15	14	17	2	191	5	196	55	31 10¼	—			—	4	Sept.
8¶	80	R.I.R. Miss M. Bennett, Ballysallagh, Kilderry, Co. Kilkenny.	March	475	4 0	6 0	1	22	23	22	19	25	27	26	11	12	12	—	97	103	200	48	29 2	1	8 19 8¾	(a) 1,164 lbs. ozs. dr. (b) 157 5 12 ozs. (c) 26·0	—	3	Sept.
			,,	476	3 8	5 4	—	—	—	14	22	25	26	23	16	16	19	6	165	2	167	1	22 3¼	—			—	—	Sept.
			,,	477	5 0	4 8	9	21	22	19	16	24	26	16	10	18	14	4	197	2	199	61	31 11½	—			—	3	—
			,,	478	4 8	6 0	—	19	21	21	18	25	25	25	24	16	22	5	217	4	221	50	33 10¾	—			—	1	—
			,,	479	5 8	5 0	4	26	23	23	21	22	19	13	14	5	8	—	178	—	178	63	29 11¾	—			—	—	Sept.
			,,	480	5 0	6 0	12	23	23	19	14	21	25	10	22	8	18	3	195	3	198	68	32 2¾	—			—	3	—
*¶	94	Light Sussex. Miss E. Walsh, Ballylemon Lodge, Cappagh, Co. Waterford.	28/2/28	559	5 8	6 4	10	20	24	21	19	25	26	11	21	12	6	10	38	167	205	20	28 5¾	2	8 19 6¼	(a) 1,178 lbs. ozs. dr. (b) 152 10 9 ozs. (c) 24·9	—	1	July
			,,	560	5 8	6 12	1	10	18	21	22	24	18	21	15	14	21	15	155	45	200	19	29 5¼	—			—	5	—
			,,	561	5 0	6 0	—	—	6	16	16	20	18	7	22	7	21	—	140	3	143	14	20 0	—			—	1	—
			,,	562	5 8	6 12	14	27	27	27	28	30	30	18	22	18	14	4	243	16	259	82	41 3¾	—			—	1	—
			,,	563	5 8	6 8	4	17	24	23	21	27	19	13	4	—	3	—	154	1	155	57	26 0½	—			—	1	Sept.
			,,	564	5 8	6 0	9	26	22	19	24	18	18	17	19	16	14	12	171	43	214	58	33 9¾	—			—	4	Sept.
9¶	78	R.I.R. Mrs. A. L. Hurley, Cloncorban, Ballineen, Co. Cork.	March	463	4 8	5 12	6	25	23	22	19	27	27	27	24	21	26	11	247	11	258	60	40 1¾	—	8 19 2	(a) 1,150 lbs. ozs. dr. (b) 154 5 13 ozs. (c) 25·8	—	—	Sept.
			27/2/28	464	5 8	5 0	5	23	21	22	3	21	21	25	14	9	15	1	178	2	180	60	29 2¼	—			—	2	—
			,,	465	4 12	—	—	—	11	20	9	17	25	25	25	23	20	—	83	92	175	17	22 0¼	—			30/8/29	—	—
			,,	466	5 0	6 4	9	27	18	12	4	16	17	13	8	2	2	3	104	27	131	52	22 1	—			—	—	Sept.
			,,	467	5 0	5 4	6	21	22	15	3	21	23	23	21	16	3	10	182	2	184	55	28 11½	—			—	—	Sept.
			,,	468	4 8	6 4	14	25	26	24	21	25	18	11	21	16	10	11	218	4	222	76	36 9¼	—			—	—	July
10‡	64	White Wyandotte. Mrs. J. M. Walsh, Ballyvoreen Ho., Murroe, Co. Limerick.	4/3/28	379	4 8	5 4	—	—	9	23	21	26	27	28	26	25	28	12	216	9	225	17	31 2¾	—	8 16 0½	(a) 1,153 lbs. ozs. dr. (b) 153 4 3 ozs. (c) 25·5	—	—	Sept.
			,,	380	4 0	5 4	6	25	21	16	19	24	21	—	7	11	6	1	157	—	157	62	26 9¼	—			—	—	Sept.
			,,	381	4 0	5 0	11	23	21	22	19	22	19	20	20	20	17	6	214	6	220	61	35 3	—			—	—	—
			,,	382	4 8	6 0	7	18	24	20	20	23	24	26	20	24	19	13	230	8	238	53	36 10½	—			—	—	Sept.
			,,	383	4 0	5 8	8	22	27	13	19	28	26	14	8	12	7	—	117	67	184	44	28 1¼	—			—	1	Sept.
			,,	384	5 0	5 4	1	6	6	5	7	20	20	18	8	16	10	12	116	13	129	9	17 9¾	—			—	1	—

‡ Pen also competing in Section II.
¶ Pen also competing in Section IV.
* Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).
† Disqualified under Clause 24 (eggs failed to reach standard weight of 24 ozs. per dozen).

SECTION VI.—SITTING BREEDS (STATION HOLDERS)—*continued*.

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Gadre.	No. of Second Grade	Total.	First Grade Eggs, 16th Oct. 15th Jan.	Value per Pullet (s. d.)	Untrapped Eggs	Total Value of Eggs from Pen (£ s. d.)	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
		R.I.R.	March	487	5 0	7 0	6	19	19	25	14	22	26	24	23	24	23	13	215	23	238	35	36 0¼	1		(a) 1,277	—	—	—
*¶	82	Mrs. K. Sheehy,	,,	488	5 0	6 0	11	24	25	24	9	26	28	30	28	25	27	11	24	244	268	1	35 1¾	—		lbs. ozs. dr.	—	—	Sept.
		Bridge House,	,,	489	5 8	5 4	8	14	—	13	9	19	26	25	20	18	21	14	145	42	187	8	25 8¾	—	8 15 4	(b) 161 15 12	—	2	Sept.
		Ballingarry,	,,	490	4 8	5 0	—	2	3	23	21	15	16	27	25	25	19	12	177	11	188	12	26 2½	—		ozs.	—	1	Nov.
		Co. Limerick.	,,	491	4 8	5 12	12	20	21	22	19	16	26	22	25	15	21	11	122	108	230	12	33 1¼	—		(c) 24·4	—	1	Sept.
			,,	492	4 8	6 0	—	—	—	—	7	23	25	29	24	25	20	12	83	82	165	—	18 11	—			—	—	—
		White Wyandotte.	1/3/28	415	4 4	4 12	3	23	26	25	12	25	18	20	12	6	13	2	132	53	185	48	29 4½	—		(a) 1,117	—	5	May
11‡	70	Miss C. Sweeney,	,,	416	4 8	4 12	—	15	24	19	5	29	20	27	20	17	7	11	179	15	194	42	29 5½	—		lbs. ozs. dr.	—	4	Sept.
		Cloonroan Ho.,	,,	417	4 4	4 0	12	24	23	14	11	22	25	20	17	19	16	6	207	2	209	65	33 5¼	—	8 12 10¼	(b) 154 0 2	—	1	Sept.
		Castlerea,	,,	418	4 8	—	—	5	14	8	—	—	—	—	—	—	—	—	20	7	27	20	5 9½	—		ozs.	16/2/29	—	—
		Co. Roscommon.	,,	419	4 0	6 0	—	7	25	25	22	22	28	27	24	15	15	12	222	—	222	44	33 4	—		(c) 26·5	—	—	June
			,,	420	4 0	5 0	—	5	30	25	26	30	30	31	30	29	29	15	279	1	280	46	41 5½	—			—	—	Sept.
		White Wyandotte.	March	451	4 0	—	—	22	24	24	21	25	25	19	9	—	—	—	44	125	169	5	24 1¾	—		(a) 1,102	28/8/29	—	—
*‡	76	Mrs. J. Tomkins,	,,	452	4 8	4 4	9	20	21	20	19	21	23	17	15	16	10	10	196	5	201	57	32 1	—		lbs. ozs. dr.	—	1	Sept.
		Ballygullen,	,,	453	5 0	5 12	9	20	25	23	22	26	20	25	10	21	6	1	205	3	208	62	33 5¾	—	8 11 4¾	(b) 146 7 12	—	—	Sept.
		Craanford,	,,	454	5 0	5 4	2	25	21	22	17	19	15	19	17	13	7	4	172	9	181	53	29 7	—		ozs.	—	2	June
		Gorey,	,,	455	4 8	5 12	—	17	29	25	20	20	16	18	17	7	12	8	169	20	189	46	30 5¼	—		(c) 25·5	—	2	April
		Co. Wexford.	,,	456	4 0	4 2	—	14	22	22	19	19	21	21	16	—	—	—	50	104	154	19	21 8	—			—	—	—
		Buff Rock.	28/2/28	541	4 8	6 8	—	14	18	22	21	24	24	24	23	24	21	11	226	—	226	42	34 1¾	—		(a) 1,059	—	—	—
12¶	91	Mrs. M. Ffrench,	,,	542	5 0	6 0	9	24	20	22	19	—	21	13	15	11	12	6	172	—	172	63	29 0¼	—		lbs. ozs. dr.	—	—	Sept.
		Poulfaille Cottage,	,,	543	5 8	5 8	—	14	23	20	20	25	21	21	16	20	3	—	183	—	183	46	28 4¾	—	8 10 1¼	(b) 155 1 13	—	—	Aug.
		New Ross,	,,	544	4 8	6 4	—	15	18	10	18	17	13	19	5	5	5	—	125	—	125	33	20 4¼	—		ozs.	—	—	Sept.
		Co. Wexford.	,,	545	5 0	—	11	24	21	24	18	20	24	25	16	12	4	—	199	—	199	68	32 3	—		(c) 28·1	10/9/29	—	Sept.
			,,	546	5 0	6 8	—	24	22	19	18	23	23	3	6	13	—	3	153	1	154	55	25 11¼	—			—	—	Sept.
		Buff Rock.	Feb. or March	529	5 8	6 8	6	17	19	22	18	24	24	21	19	16	12	8	199	7	206	52	31 10¾	1		(a) 1,143	—	—	Sept.
13¶	89	Mrs. L. Mounsey,	,,	530	5 8	5 12	—	—	10	18	9	21	20	9	25	9	24	10	154	1	155	20	22 1¾	—		lbs. ozs. dr.	—	1	Sept.
		Beech Hill,	,,	531	5 0	6 8	—	22	22	21	20	21	25	17	19	7	13	11	198	—	198	54	31 7½	—	8 8 10½	(b) 163 11 11	—	1	July.
		Ballyduff,	,,	532	5 4	6 8	—	—	—	22	22	25	28	22	13	19	22	11	184	—	184	11	25 3¼	—		ozs.	—	—	Nov.
		Tullamore,	,,	533	5 8	6 8	—	14	25	25	17	29	24	22	11	23	20	10	218	2	220	50	34 3¾	—		(c) 27·5	—	1	June
		Offaly.	,,	534	4 8	5 8	—	2	1	—	20	28	24	26	22	25	21	10	178	1	179	3	23 4¾	—			—	1	Nov.

‡ Also competing in Section II.
¶ Also competing in Section IV.
* Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).

SECTION VI.—SITTING BREEDS (STATION HOLDERS)—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival	Weight: At Close of Test	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet	Untrapped Eggs	Total Value of Eggs from Pen	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
					lb. oz.	lb. oz.																	s. d.		£ s. d.				
*‡	62	White Wyandotte.	Feb.	367	4 0	—	13	27	19	19	19	29	3	—	—	—	—	—	97	32	129	52	23 $4\frac{3}{4}$	—		(a) 1,063	5/4/29	—	—
		Mrs. M. Byrne,	"	368	4 0	—	—	17	23	19	23	29	7	—	—	—	—	—	87	31	118	48	20 $6\frac{1}{4}$	—		lbs. ozs. dr.	8/5/29	—	—
		Knockbutton,	"	369	4 8	5 0	—	17	19	18	16	21	23	18	22	22	19	—	187	3	190	43	29 3	—	8 8 $4\frac{3}{4}$	(b) 136 2 2	—	—	June
		Windgap,	"	370	4 4	5 4	3	25	28	25	23	29	25	28	18	24	24	11	233	30	263	65	41 $0\frac{3}{4}$	—		ozs.	—	—	June
		Co. Kilkenny.	"	371	4 4	—	4	26	24	18	21	25	23	17	1	—	—	—	135	24	159	50	26 $4\frac{1}{4}$	—		(c) 24·6	2/8/29	—	May
			"	372	4 4	4 8	10	14	10	21	18	25	27	17	22	19	9	12	89	115	204	31	27 $9\frac{3}{4}$	—			—	3	June
*†¶	92	Barred Rock.	21/4/28	547	4 8	6 0	3	15	19	14	16	21	20	21	16	19	15	7	59	127	186	2	25 2	—		(a) 1,226	—	—	Sept.
		Mrs. B. Power,	"	548	4 8	6 8	—	—	8	8	21	27	13	18	16	11	3	14	40	99	139	—	16 $11\frac{3}{4}$	—		lbs. ozs. dr.	—	5	—
		Slieverue,	"	549	5 0	5 4	11	12	4	22	24	26	25	26	23	25	20	14	25	207	232	—	28 $7\frac{1}{4}$	—	8 6 $5\frac{3}{4}$	(b) 148 11 3	—	1	—
		Butlerstown,	"	550	5 8	—	9	22	25	23	22	30	28	24	8	6	—	—	181	16	197	56	31 $5\frac{1}{2}$	—		ozs.	28/8/29	1	June & July
		Co. Waterford.	"	551	4 8	5 12	—	—	—	21	20	26	26	27	25	27	27	13	174	38	212	3	27 $10\frac{1}{4}$	—		(c) 23·3	—	—	—
			"	552	4 12	5 12	7	28	30	28	26	30	24	17	22	18	14	16	48	212	260	1	36 5	—			—	3	—
*¶	79	R.I.R.	14/3/28	469	4 8	5 4	1	20	24	21	5	14	15	20	20	5	—	11	149	7	156	52	25 $7\frac{1}{4}$	—		(a) 1,117	—	2	Sept.
		Miss K. Morrissey,	"	470	4 0	4 4	3	24	27	23	20	24	27	18	15	20	18	1	76	144	220	27	31 $6\frac{3}{4}$	—		lbs. ozs. dr.	—	3	Sept.
		Jamestown,	"	471	4 12	6 0	—	—	9	23	22	21	18	19	15	16	15	7	61	104	165	1	21 $1\frac{1}{4}$	—	8 6 1	(b) 146 13 13	—	5	—
		Piltown,	"	472	4 8	5 8	—	17	21	17	16	21	22	22	19	21	17	7	196	4	200	46	30 $0\frac{3}{4}$	—		ozs.	—	—	Sept.
		Co. Kilkenny.	"	473	4 12	5 4	13	13	21	20	7	22	23	17	16	14	16	12	151	43	194	38	29 5	—		(c) 25·2	—	5	—
			"	474	4 8	5 12	—	7	20	23	21	20	22	22	14	18	15	—	180	2	182	39	27 7	—			—	1	Sept.
14¶	93	Barred Rock.	16/3/28	553	5 4	6 0	6	21	23	21	20	28	27	19	2	5	—	10	175	7	182	56	20 $7\frac{1}{4}$	—		(a) 1,042	—	1	—
		Mrs. E. A. Henderson, Ardrum,	22/3/28	554	5 0	5 4	8	16	18	10	5	11	7	18	1	—	—	1	80	15	95	42	16 6	—		lbs. ozs. dr.	—	—	Sept. & July
		Inniscarra,	"	555	5 4	6 12	3	15	23	19	18	28	29	25	12	19	16	6	205	8	213	52	32 $6\frac{1}{4}$	—	8 2 $6\frac{1}{2}$	(b) 141 4 7	—	1	—
		Co. Cork.	16/3/28	556	5 0	7 0	8	18	4	22	19	25	24	25	23	22	19	3	143	69	212	23	29 $7\frac{1}{2}$	—		ozs.	—	—	Sept.
			22/3/28	557	4 12	—	5	3	20	18	17	22	18	—	—	—	—	—	95	8	103	29	16 $9\frac{3}{4}$	—		(c) 26·0	1/5/29	—	—
			16/3/28	558	5 8	6 8	9	24	21	18	21	25	27	22	16	18	23	12	237	—	237	63	37 $5\frac{3}{4}$	—			—	—	—
†*‡	68	White Wyandotte.	March	403	4 8	5 4	—	11	17	17	15	20	21	23	20	6	20	11	157	24	181	21	26 8	—		(a) 1,103	—	1	July
		Mrs. N. Egan,	"	404	4 0	4 12	—	16	25	21	22	26	11	19	13	19	8	13	—	193	193	—	25 9	—		lbs. ozs. dr.	—	—	—
		Liscam House,	"	405	4 4	5 12	15	23	27	23	18	22	19	18	8	2	12	—	95	92	187	11	28 $11\frac{3}{4}$	—	8 0 $5\frac{1}{2}$	(b) 132 1 12	—	—	Sept.
		Athlone,	"	406	4 12	6 0	9	29	25	26	21	20	25	16	18	18	8	—	101	114	215	8	31 11	—		ozs.	—	—	Sept.
		Co. Roscommon.	"	407	4 4	—	9	24	21	25	21	25	22	1	—	—	—	—	59	89	148	24	23 $6\frac{3}{4}$	—		(c) 23·0	5/5/29	—	—
			"	408	4 0	5 0	—	23	22	6	7	22	23	18	18	16	17	7	18	161	179	1	23 7	—			—	—	Sept.

‡ Also competing in Section II.
† Disqualified under Clause 24 (eggs failed to reach standard weight of 24 ozs. per dozen).
* Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).
¶ Also competing in Section IV.

SECTION VI.—SITTING BREEDS (STATION HOLDERS)—*continued*.

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
15‡	59	White Wyandotte. Mrs. M. Nagle, Springmount, Mallow. Co. Cork.	26/2/28	349	4 8	3 8	9	17	25	22	22	21	17	19	15	11	—	—	62	116	178	30	25 11¼	3	7 17 6½	(a) 1,041 (b) lbs. ozs. dr. 138 9 4 (c) ozs. 25·6	—	3	June
			March	350	4 8	4 8	10	21	24	19	20	26	26	25	20	—	16	4	211	—	211	63	33 8½	—			—	—	June & Aug.
			,,	351	5 0	6 0	—	3	6	3	3	10	11	10	10	10	9	5	74	6	80	6	11 1¼	—			—	—	June
			,,	352	5 0	6 0	12	20	19	19	4	18	17	15	13	10	13	11	136	35	171	31	27 0¼	—			—	7	May
			,,	353	4 12	5 4	13	20	22	9	—	21	27	24	22	18	21	11	206	2	208	58	32 3	—			—	—	Jan.
			,,	354	4 12	5 0	—	—	13	24	21	25	26	25	9	23	13	11	178	12	190	22	27 1	—			—	2	June & Sept.
16‡	73	White Wyandotte. Mrs. A. B. Barber, Knockbeg Ho., Collooney, Co. Sligo.	1/3/28	433	4 8	—	10	13	22	16	12	26	15	14	13	16	18	5	161	19	180	53	28 4	—	7 13 2¾	(a) 1,023 (b) lbs. ozs. dr. 132 15 12 (c) ozs. 25·0	12/9/29	5	Sept.
			,,	434	4 12	6 12	—	15	18	20	16	20	10	21	14	11	16	7	165	3	168	43	26 9¼	—			—	2	April
			,,	435	5 0	5 4	7	19	10	4	21	21	14	19	9	10	21	2	123	34	157	30	23 7½	—			—	1	Sept.
			,,	436	4 8	4 8	2	8	24	25	24	24	23	24	20	24	20	10	174	54	228	26	33 1	—			—	—	Sept.
			,,	437	4 8	5 12	—	3	7	12	14	20	12	9	11	10	11	2	90	21	111	12	15 7¾	—			—	—	Sept.
			,,	438	4 8	4 4	—	13	20	8	10	24	24	20	22	21	13	4	152	27	179	29	25 9¼	—			—	—	Sept.
¶§	81	R.I.R. Miss E. M. Scanlan, Ballyduhig Ho., Ballagh, Charleville.	March	481	4 8	6 0	—	22	25	22	24	24	25	23	18	19	19	9	229	1	230	57	36 3½	—	7 5 5½	(a) 957 (b) lbs. ozs. dr. 136 15 7 (c) ozs. 27·6	—	—	—
			,,	482	4 8	6 0	—	9	13	18	16	2	27	22	17	22	16	3	165	—	165	30	24 4¼	—			—	1	—
			,,	483	4 12	—	6	20	22	7	—	—	—	—	—	—	—	—	1	54	55	1	10 8	—			11/4/29	—	—
			,,	484	4 8	5 8	2	19	—	7	19	23	22	23	22	23	25	10	183	12	195	18	27 10¼	—			—	—	Sept.
			,,	485	4 12	6 0	—	—	15	—	22	24	24	21	19	17	3	13	156	2	158	14	21 7½	—			—	2	June
			,,	486	4 4	5 4	5	16	13	20	21	19	20	14	10	—	6	10	152	2	154	44	24 8	—			—	1	July
¶§	85	Buff Rock. Mrs. N. Ryan, Cluggin House, Oola, Co. Limerick.	6/3/28	505	4 8	5 4	—	17	23	23	22	27	24	11	23	18	11	15	183	31	214	39	32 8¼	—	6 18 8	(a) 901 (b) lbs. ozs. dr. 118 3 7 (c) ozs. 25·2	—	2	Sept.
			,,	506	5 0	6 0	10	19	20	19	18	25	24	22	12	23	9	11	210	2	212	57	33 5	—			—	1	Sept.
			,,	507	4 8	5 0	10	14	4	—	18	25	21	17	13	15	19	—	107	49	156	15	21 5¼	—			—	4	Jan. & Sept.
			,,	508	4 8	5 0	11	20	23	21	18	23	22	26	9	25	19	12	195	34	229	56	35 8¾	—			—	1	—
			,,	509	4 0	5 4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			—	2	Jan.
			,,	510	4 8	—	3	—	24	22	23	18	—	—	—	—	—	—	58	32	90	27	15 4¾	—			3/4/29	—	—
‡§	71	White Wyandotte. Mrs. J. Spellman, Ardmore, Boyle, Co. Roscommon.	March	421	4 0	—	12	24	21	1	—	—	—	—	—	—	—	—	51	7	58	51	13 1¾	1	6 17 6¾	(a) 858 (b) lbs. ozs. dr. 120 2 14 (c) ozs. 26·9	7/3/29	—	—
			,,	422	4 4	5 0	—	—	9	22	19	23	23	22	16	23	21	10	185	3	188	20	26 8½	—			—	1	Oct. & June
			,,	423	4 4	—	—	6	—	—	—	—	—	—	—	—	—	—	4	2	6	4	1 5	—			21.12.28	—	—
			,,	424	4 4	4 4	8	24	25	21	18	22	22	23	22	21	19	10	235	—	235	66	37 6¾	—			—	—	Sept.
			,,	425	4 8	5 0	6	25	24	20	17	23	24	22	23	11	11	2	205	3	208	64	33 3½	—			—	—	Aug.
			,,	426	5 4	6 4	6	14	15	15	10	12	19	18	17	15	14	7	162	—	162	43	25 3	—			—	—	June

‡ Also competing in Section II. ¶ Also competing in Section IV. § Disqualified under Clause 26 (pen produced less than 1,020 eggs).

SECTION VI.—SITTING BREEDS (STATION HOLDERS)—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Pullet: No. of First Grade	No. of Second Grade	Total	First Grade Eggs, 16th Oct.-15th Jan.	Value per Pullet s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
*‡§	72	White Wyandotte.	March	427	4 8	—	4	17	1	—	—	—	—	—	—	—	—	—	6	16	22	6	4 7½	2		(a) 881	2/12/28	—	—
		Mrs. Hand,	,,	428	4 8	5 12	—	12	23	23	21	24	23	20	6	—	—	—	150	2	152	46	24 3¾	—		lbs. ozs. dr.	—	1	—
		Berries Hill,	,,	429	4 8	5 0	—	4	19	15	18	22	24	24	14	23	20	12	1	194	195	—	23 5¾	—	6 5 7¾	(b) 110 3 7	—	1	Nov. & Sept.
		Athlone.	,,	430	4 8	6 0	—	15	25	16	9	9	2	—	—	—	—	—	66	10	76	44	15 0¼	—		ozs.	—	—	June
			,,	431	5 0	5 8	6	23	22	5	17	25	24	23	10	18	18	9	194	6	200	54	31 4½	—		(c) 24·0	—	1	—
			,,	432	4 0	4 8	—	—	5	26	24	28	29	29	22	29	28	14	1	233	234	—	26 7	—			—	—	—
¶§	95	Light Sussex.	Feb.	565	5 8	7 4	—	—	7	26	26	16	14	17	11	14	6	4	107	34	141	13	19 9¾	—		(a) 821	—	5	Sept. & Oct.
		Miss M. Johnston,	,,	566	5 0	7 8	—	—	—	15	20	18	18	11	16	12	11	4	121	4	125	3	17 0	—		lbs. ozs. dr.	—	5	Oct. & Sept.
		Seaview,	,,	567	5 8	7 4	—	—	—	22	17	22	19	14	14	14	12	1	126	9	135	9	18 5¼	—	5 14 7¼	(b) 112 13 2	—	3	Oct. & Sept.
		Murrintown,	,,	568	5 8	7 4	—	—	—	9	18	24	21	15	13	12	7	3	122	—	122	—	16 0½	—		ozs.	—	2	Sept.
			,,	569	5 8	5 8	—	2	22	26	23	27	9	19	15	13	12	5	169	4	173	36	26 8½	—		(c) 26·4	—	4	Sept.
		Wexford.	,,	570	5 0	—	—	—	12	19	16	20	18	16	13	11	—	—	71	54	125	5	16 7¼	—			19/8/29	2	Oct.
¶§	90	Buff Rock.	Feb.	535	5 0	—	1	7	2	—	—	—	—	—	—	—	—	—	9	1	10	9	2 4¾	—		(a) 469	15/1/29	—	—
		Miss M. Dempsey,	,,	536	4 8	—	—	—	—	11	12	2	—	—	—	—	—	—	25	—	25	3	4 2½	—		lbs. ozs. dr.	1/6/29	—	—
		Movilla,	,,	537	4 12	4 8	—	—	—	—	—	11	23	17	15	10	—	—	75	1	76	—	8 7¾	—	3 11 1¾	(b) 64 1 0	—	—	Aug.
		Oulart,	,,	538	5 0	4 12	—	—	16	24	21	26	28	20	12	11	16	8	104	78	182	26	25 7¾	—		ozs.	—	4	—
		Gorey,	,,	539	4 8	—	—	—	12	19	9	7	—	—	—	—	—	—	45	2	47	17	8 8½	—		(c) 26·2	7/5/29	—	—
		Co. Wexford.	,,	540	5 0	—	4	18	17	19	16	19	11	15	10	—	—	—	122	7	129	45	21 6½	—			5/9/29	3	—

‡ Also competing in Section II.
¶ Also competing in Section IV.
* Disqualified under Clause 26 (more than 20 per cent. second-grade eggs).
§ Disqualified under Clause 26 (pen produced less than 1,020 eggs).

DUCK SECTION.

Order of Merit	No. of Pen	Name and Address of Owner	Time of Hatching	No. of Duck	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March	April	May	June	July	August	16th Sept., inclusive	Eggs per Duck: First Grade	Second Grade	Total	Value per Duck s. d.	Untrapped Eggs	Total Value of Eggs per Pen £ s. d.	(a) Total Eggs per Pen (b) Total Weight (c) Average Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
1	100	Khaki Campbell. Mrs. K. Healy, Clonmeen, Banteer, Co. Cork.	March	587	4 0	4 4	7	16	18	15	17	17	18	21	18	24	15	8	191	3	194	24 6½	—	6 5 10	(a) 1,002; (b) lbs. ozs. dr. 152 13 6; (c) ozs. 29·3	—	—	June
			,,	588	4 0	3 12	13	19	30	27	22	30	29	30	29	26	28	15	234	64	298	36 11¼	—			—	—	June
			,,	589	4 8	5 0	15	16	21	19	17	27	30	27	29	20	22	12	251	4	255	31 9¼	—			—	—	June
			,,	590	4 4	4 4	16	24	28	29	24	31	23	21	24	22	11	2	198	57	255	32 7	—			—	—	June & Aug.
2	99	Indian Runner. Mrs. A. McGrath, Bamfort, Co. Kilkenny.	5/4/28	583	3 8	3 8	14	24	16	3	17	24	25	23	26	25	26	13	229	7	236	20 7	—	6 3 7¼	(a) 991; (b) lbs. ozs. dr. 151 15 15; (c) ozs. 29·4	—	—	—
			,,	584	4 0	4 0	13	25	19	7	16	26	30	26	24	20	14	4	213	11	224	27 11¾	—			—	—	May
			,,	585	3 0	3 8	1	23	27	13	20	28	30	25	28	27	15	1	194	44	238	28 11½	—			—	—	—
			,,	586	3 8	4 0	12	25	26	28	24	29	29	25	23	27	30	15	246	47	293	37 1	—			—	—	June
*	101	Khaki Campbell. Mrs. C. O'Shea, Codrum, Macroom, Co. Cork.	31/5/28	591	3 0	3 2	—	—	25	28	22	25	29	25	20	24	25	13	181	55	236	27 11½	—	5 19 11	(a) 1,011; (b) lbs. ozs. dr. 142 11 6; (c) ozs. 27·1	—	—	—
			,,	592	3 8	3 2	—	13	25	28	22	30	30	28	16	28	31	13	144	120	264	31 3½	—			—	—	—
			,,	593	4 0	3 4	—	4	29	27	16	14	30	30	23	28	31	16	191	57	248	29 5¼	—			—	—	—
			,,	594	4 0	3 4	—	18	27	28	22	26	27	25	26	22	28	14	126	137	263	31 2¾	—			—	—	—
3	102	Khaki Campbell. Mrs. E. M. Percival, Temple House, Ballymote, Co. Sligo.	31/3/28	595	4 8	4 4	7	30	23	27	21	30	29	29	27	23	21	16	227	56	283	35 4½	1	5 16 1½	(a) 970; (b) lbs. ozs. dr. 148 6 9; (c) ozs. 29·4	—	—	July
			,,	596	4 8	4 12	—	—	—	—	23	29	28	26	27	27	26	11	197	—	197	21 11¾	—			—	—	—
			,,	597	4 8	4 0	10	23	29	27	18	31	30	28	30	29	31	15	279	22	301	37 10	—			—	—	—
			,,	598	4 4	4 0	—	—	—	—	18	28	30	26	23	27	27	9	183	5	188	20 9½	—			—	—	Oct.
4	98	Indian Runner. Mrs. M. Cruite, Tulla, Three Castles, Co. Kilkenny.	April	579	4 0	3 12	—	—	6	25	27	30	30	27	24	29	20	11	222	7	229	26 9¼	—	5 12 7¼	(a) 928; (b) lbs. ozs. dr. 145 9 12; (c) ozs. 29·0	—	—	—
			,,	580	4 0	4 8	—	—	5	25	25	28	23	24	13	15	4	2	156	8	164	19 1¼	—			—	—	—
			,,	581	3 8	3 12	5	25	18	20	21	25	26	26	26	29	21	12	236	18	254	31 8	—			—	—	—
			,,	582	3 8	4 0	3	29	28	25	11	31	30	29	30	26	24	15	249	32	281	35 0¾	—			—	—	—

* Disqualified under Clause 14 (pen producing more than 15 per cent. second-grade eggs).

DUCK SECTION—*continued.*

Order of Merit	No. of Pen	Name and Address of Owner	Time of Hatching	No. of Duck	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	No. of Eggs Laid: 16th October inclusive	November	December	January	February	March,	April	May	June	July	August	16th Sept., inclusive	Eggs per Duck: First Grade	Second Grade	Total	Value per Duck s. d.	Untrapped Eggs	Total Value of Eggs from Pen £ s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen	Date of Death	No. of Times Broody	Date of Moulting
5	97	Indian Runner.	6/5/28	575	3 8	—	—	—	18	31	25	3	—	—	—	—	—	—	33	44	77	10 9¼	—	5 7 4	(a) 847	March	—	—
		Mrs. R. Verling,	„	576	3 8	4 4	—	24	24	19	25	29	29	27	29	21	30	15	271	1	272	34 1½	—		lbs. ozs. dr. (b) 140 12 6	—	—	July
		Kill St. Anne, Castlelyons,	„	577	4 0	4 4	13	25	29	29	25	4	24	31	30	24	30	13	259	18	277	35 5½	—		ozs.	—	—	March
		Fermoy.	„	578	3 8	4 4	—	10	16	26	25	28	27	26	20	21	22	—	217	4	221	26 11¾	—		(c) 31·9	—	—	Aug.
*	103	Khaki Campbell. Mrs. K. O'Connor,	30/4/28	599	3 8	3 12	—	—	—	—	—	25	24	23	22	26	26	1	104	43	147	15 2½	4	4 2 1½	(a) 702	—	—	June
		Ballycrystal,	„	600	3 8	3 8	—	—	—	—	16	24	23	23	16	14	—	2	106	12	118	12 5¾	—		lbs. ozs. dr.	—	—	May & Aug.
		Ferns, Co. Wexford.	„	601	3 8	3 8	—	15	30	21	21	27	29	25	20	21	28	11	177	71	248	30 2¼	—		(b) 103 1 9	—	—	June
			„	602	3 8	4 8	1	23	22	26	24	22	28	27	12	—	—	—	169	16	185	23 8¼	—		ozs. 28·2	—	—	July
6	108	Indian Runner. Mrs. M. F. Shiel-Walsh,	March or April	627	3 12	3 12	—	—	—	15	27	30	30	29	7	—	—	—	112	26	138	15 3	2	4 1 10½	(a) 708	—	1	May
		Moneyvroe,	„	628	4 8	4 12	—	17	13	4	25	30	29	20	25	—	16	13	192	—	192	23 5¾	—		lbs. ozs. dr.	—	1	June
		Cappoquin,	„	629	3 12	4 0	—	—	11	28	26	31	29	23	19	—	—	—	158	9	167	19 7½	—		(b) 115 6 9 ozs.	—	—	Oct. & June
		Co. Waterford.	„	630	3 4	4 0	—	—	—	19	22	31	30	30	29	28	18	2	199	10	209	23 3½	—		(c) 31·3	—	—	June
‡	96	Indian Runner. Mrs. J. E. Delaney,	21/3/28	571	3 0	3 8	—	—	—	—	—	8	29	23	26	9	—	—	92	3	95	8 11½	2	3 2 6	(a) 581	—	—	Aug.
		Newtown House,	„	572	3 8	4 4	—	—	—	21	24	24	27	20	18	25	30	—	164	25	189	21 6¾	—		lbs. ozs. dr.	—	—	—
		Crettyard,	„	573	3 0	3 12	—	—	—	—	13	26	24	25	25	28	26	8	164	11	175	19 2½	—		(b) 88 2 11 ozs.	—	—	June
		Carlow.	4/4/28	574	3 0	3 12	—	—	—	—	—	13	15	21	16	31	24	—	87	33	120	12 6	—		(c) 29·1	—	—	—

* Disqualified under Clause 14 (pen producing more than 15 per cent. second-grade eggs).
‡ Disqualified under Clause 14 (pen producing less than 680 eggs).

Obituary.

THE LATE MR. T. P. GILL.

We have to record, with deep regret, the death on 19th January, 1931, of Mr. T. P. Gill, Secretary of the Department of Agriculture and Technical Instruction from its formation in 1900 until his retirement in 1923. He was, with Sir Horace Plunkett, co-founder of the Department. Not only was he the Secretary of the Recess Committee of 1896, which led to the establishment of the Department, but he also took a prominent part in the organisation of the Round Table Conference out of which that Committee sprang. The Report of the Committee was very largely based upon the personal investigations into agricultural education and development carried out by him in various Continental countries on behalf of the Committee.

When the Department was set up by the Act of 1899, Mr. Gill was a chief framer of its organisation and policy, and was able, owing to his intimate knowledge of Irish life and character, to do much towards keeping the Department in touch with the country as a whole, and in co-ordinating its work with the spheres of Secondary, Technical and University Education. The erection of the present fine buildings for the accommodation of the College of Science and of Government Offices owed much to his active interest in the scheme. Mr. Gill was the first representative of the Department at the International Institute of Agriculture in Rome, and from the foundation of that Institute in 1905 always

took a personal interest in its work and progress. At the first session of the Institute after the European War, he was elected President of the Committee on Economic and Social Policy of the General Assembly of the Institute. Amongst the positions held by Mr. Gill for various periods were those of Commissioner for Intermediate Education; Senator of the National University, and President of the Irish Technical Instruction Association.

To the end of his life, in spite of failing health, Mr. Gill carried on good work on behalf of the community in his capacity of Chairman of the Irish Free State Central Savings Committee, the success of which undoubtedly owes much to his voice and pen. By the death of Mr. Gill the country has lost one who for many years, and often under difficult conditions, served it well.

THE LATE MR. JOHN HOOPER, B.A.

We have also to chronicle with regret the recent death of Mr. John Hooper, B.A., Director of Statistics, Department of Industry and Commerce. Mr. Hooper, who, after a distinguished University career, entered the First Division of the Civil Service, was for over seven years Superintendent of the Statistics and Intelligence Branch of the Department of Agriculture and Technical Instruction for Ireland, and was responsible for most of the Department's Statistical Publications. On the re-organisation of the various State Departments a bureau of Statistics was established in the Department of Industry and Commerce, and Mr. Hooper was made the first Director. In that capacity he was responsible for the compilation and co-ordination of the Statistics heretofore collected in the Department of Agriculture and other Departments, and before his untimely death he had already raised the new bureau to a standard that compared very favourably with State Statistical bureaux in other countries.

Mr. Hooper had been, up to a few weeks before his death, President of the Statistical and Social Inquiry Society of Ireland, and had recently been elected a member of the International Institute of Statistics. It was intended that the degree of Doctor of Economic Science should be conferred upon him by the National University in recognition of his statistical work for the State, and in particular for his analysis of the several volumes of the Census of Population for which he was responsible.

NOTES AND MEMORANDA.

Milk-Marketing in the United States.

The growth and development of what are known as " fluid milk marketing associations " in the United States during the past ten years has been remarkable. There are two classes of milk-marketing associations: (1) the bargaining, and (2) the operating or marketing. The bargaining type of association does not own or operate facilities for the actual handling of milk. Originally its service was to act as the agent of the producer in finding a market and arranging the terms of sale for his milk. That still is its most important work, but it has taken on many other duties, and now performs a variety of services for producers and distributors of milk. In addition to representing the producer in all price negotiations for the sale of his milk, it may guarantee that he will receive payment should the distributor fail to pay up. Other services rendered by the bargaining associations are: testing milk for sale, or checking tests made by dealers, maintaining their own inspection service for quality improvement, regulating seasonal production through control plans and guaranteeing a market for unplaced milk, supplying milk to dealers according to their requirements and representing the producers publicly in obtaining beneficial legislation, tariff adjustments, or more favourable transport rates.

The operating or marketing association, on the other hand, actually operates plants, and handles all or part of the milk. It may also perform all the functions of the bargaining association, for it must necessarily find a market and arrange terms of sale.

One of the most prominent bargaining organisations is the Maryland State Dairymen's Association, which has been in active operation since 1918. Its membership has grown from about 450 in 1918 to over 4,000 at the present time. During the year 1928, it handled nearly 223 million pounds of milk, for which it received some 8 million dollars. It operates over a relatively small territory, the most distant point from which the milk comes being 75 miles away. Starting with the control of less than 15 per cent. of the milk supply, the association now controls about 95 per cent. of the supply on the markets in which it operates.

The largest of the operating type of association is the Dairyman's League Co-operative Association (Inc.), which is a wholesale distributor operating about 240 country receiving stations. The active membership consists of some 43,000 producers, the most distant of whom is more than 400 miles from New York City. Sales for the year 1928 amounted to nearly 86 million dollars.

The milk-marketing associations in America are exercising a real influence on production, both in emphasising quality and stabilizing supply. The aim in view is to develop a marketing machinery which will reflect the premiums paid by the market for quality back to the farmer who produces the product.

Danish Dairying Statistics.

The last two annual reports, the 31st and 32nd of the series, issued by the Danish Dairying Statistics Bureau, indicate considerable progress in various directions. The number of participating creameries seems, however, to be declining. The 31st Report, which relates to the year 1927, contains returns from 826 creameries, or 67% of all the co-operative creameries in Denmark. This number showed a decline on the previous year, and a further fall took place in 1928, when the number of participating creameries was 816, or 66% of all co-operative creameries. The following table contains the principal averages for the past three years, 1926, 1927 and 1928, with the corresponding 1914 figures, by way of comparison. The Danish measures have been converted into the nearest English equivalents :—

Average.	1914.	1926.	1927.	1928.
Number of members per creamery ...	153	142	143	145
Number of cows per creamery ...	967	944	990	1,025
Annual milk yield per cow (galls.) ...	581.6	638.8	643.7	648.8
Milk used to make 1 lb. butter (lb.) ...	25.4	24.3	24.1	24.0
Price per lb. butter	1/0¾	1/7½	1/6¼	1/7
Working expenses per 100 gall. milk ...	4/6½	8/7½	7/5¾	6/9½
Nett receipts per gall. milk	5¾d.	8¾d.	8¾d.	9d.

The returns show an increase in the number of cows per creamery, an increase which is likely to be maintained. The average annual milk yield per cow has also risen, and a third factor which tends to increase butter production is the higher fat content of the milk, which means that less milk is needed to make a given quantity of butter. The amount needed to make 1 lb. butter has now fallen to 24 lb., the lowest figure yet recorded. When the first dairying statistics were published in 1898, the corresponding figure was 26.5. This means that the fat yield from any given quantity of milk is 10 per cent. greater than it was thirty years ago. The development recorded is attributed to the fact that Danish creameries are gradually abandoning the method of reckoning by cream-units in favour of the fat-units system of payment. The following table shows the percentage of all creameries which have used the two methods in each year since 1923 :—

Year.	Percentage of creameries using :— Fat-Units Method.	Cream-Units Method.
1923	17 ...	71
1924	23 ...	67
1925	31 ...	61
1926	40 ...	54
1927	46 ...	48
1928	59 ...	38

The following factors are considered to have contributed to the enormous development in butter-production which has taken place in Denmark in the past generation:—

1. An increase in the number of milch cows.
2. A greater milk yield per cow.
3. An increase in fat-content of milk.
4. A better system of dieting for milk production.
5. A more careful method of milking.

Potato Inspection in Canada.

Regulations have been issued by the Canadian Department of Commerce under the Root Vegetable Act requiring the inspection, at the loading point, of potatoes grown in New Brunswick and exported in carload or cargo shipments to another province or outside of Canada. An inspection certificate (in quadruplicate) issued by an Inspector stating that the potatoes comply with the requirements of the Act and Regulations and are of the grades designated therein, must be produced with the consignment. The Regulations came into force on 29th June, 1929.

New grades and regulations for potatoes, onions, turnips or rutabagas, and celery, grown in Canada, and dimensions for celery crates, have been established under the Root Vegetable Act, and certain tentative grades recommended for cabbage and cauliflower containers have been introduced and will be tested by growers and distributors before being included in the Regulations.

Increased Import Duty on Butter in Switzerland.

On 12th August, 1929, the duty on butter imported into Switzerland was advanced from 20 to 70 francs per 100 kilos, or from 16s. to £2 16s. 0d. per 220 lb. The object of this step is to further the home-production of butter, and as a result it is hoped that more milk will be used for butter-making and less for cheese, the cheese industry having been unremunerative in recent years. In order to prevent the Swiss from turning to the use of lard as a substitute for butter at the advanced price, the import duty on lard has also been advanced 100 per cent., namely, from 20 to 40 francs per 100 kilos, or approximately 16s. to £1 12s. 0d. The home production of butter in Switzerland was approximately 14,700 tons in 1928. Imports were something over 7,800 tons, so the total consumption would be about 22,500 tons. The import of butter from Denmark in 1928 amounted to 4,400 tons. It remains to be seen whether the higher import duty will severely check the Danish trade with Switzerland. The Danish export of butter to Switzerland has hitherto amounted to between 3 and 4 per cent. of Denmark's total export.

The Canadian Wheat Pools.

There are three wheat pools in Western Canada, the Manitoba, Saskatchewan and Alberta Co-operative Wheat Producers, respectively, to-

gether with their jointly-owned and controlled central selling agency, the Canadian Co-operative Wheat Producers, Ltd.

The Alberta pool was the first organised and opened for business in October, 1923, with a membership of 26,000 and 2,536,000 acres under contract. Saskatchewan with 47,000 members and approximately 7,000,000 acres under contract and Manitoba with 8,000 members and 720,000 acres, completed their organisation in 1924.

The main principle on which the Canadian pools have been built is that they are strictly non-profit co-operative associations. Each of the three provincial pools is a separate entity, self-controlled in every respect, with its own officials administering its own internal affairs and collecting its own grain. The central selling agency formed by the three provincial pools (the Board consists of three representatives from each province) sells the grain collected by the pools. It was established in order to eliminate any possibility of competition in selling among the three provinces.

The basic factor of the organisation of the pools in each province is the five-year contract between the grower and the pool. This contract binds the farmer to deliver during the term of the contract all the wheat grown by him except registered seed wheat and his own seed and feed requirements. From the proceeds of the sale of wheat the pool may deduct 1% of the gross selling price for a commercial reserve, and may deduct an additional 2 cents per bushel for the purchase of elevators and facilities for the handling of grain. Each pool has a contract with the selling agency in which it agrees to deliver to that organisation all the grain delivered to it by the farmers.

During the past three years the three pools in Western Canada have built up large elevator organisations. At the moment the pools are operating in the three provinces over 1,400 country elevators with an approximate storage capacity of 15,000,000 bushels. In addition, the pools have terminal elevators at Fort William, Port Arthur, Vancouver, Prince Rupert, and Buffalo, with a total storage capacity of approximately 35,000,000 bushels. The combined elevator and commercial reserve of the three pools now stands at more than 20,000,000 dollars.

The progress of co-operative marketing of wheat in Western Canada may be judged by the following figures:—

Year.	Approximate number of bushels marketed.
1924	80,000,000
1925	187,000,000
1926	180,000,000
1927	210,000,000

The pool was expected to handle at least 250,000,000 bushels of grain in 1928.

The central selling agency shipped over 114,000,000 bushels of grain to 20 countries during 1927-28, of which Great Britain imported 36,000,000 bushels.

At present the wheat pools command the support of the majority of

farmers in Western Canada, although there is a divergence of views as to their exact value. One leading Canadian holds that they have not materially helped the large operator who marketed his grain when he desired, and obtained a high price for it if he " caught " the market, but that they have been of benefit to the small man who could not sell when he liked. In fact, pool marketing provides a protection for the small grower of which the larger does not stand so much in need.

Denmark's Export Egg Trade in 1928.

The Danish Wholesale Merchants' Association, in their report on the egg trade in 1928, state that in May of that year, the existing Danish Egg Law of 1925 was superseded by a new enactment which provided for the compulsory marking of eggs intended for export, and indication of the week of shipment on the case. This step was taken with the object of giving Danish eggs a preferential position on the English market, as compared with eggs from other countries. " Though the motives underlying the egg-marking order were the best possible," continues the Report, " it cannot be denied that these regulations restricted sales, for the Danish eggs in many instances had either to wait for buyers until the available supplies of good-class unstamped eggs from other countries were cleared out, or else had to be sold at lower prices than they would otherwise have realised. The prejudice against stamped eggs, formerly very pronounced in England, was equally evident in 1928, and moreover the week-marks on the cases proved to be a hindrance to importers in disposing of their purchases. The two in conjunction have brought it about that Danish stamped eggs, in spite of their fine quality, have often had to give way to other (unstamped) eggs."

The trade in preserved eggs was not so good in 1928 as it had been in 1927. The number of eggs preserved was larger than in the previous year, and a certain quantity of these remained unsold at the close of 1928 and had to be carried over to the following year.

The total export of Danish eggs (fresh and preserved) in 1928 amounted to 547,919 cases, containing 72 score each, as compared with 586,606 cases in 1927. The principal markets were England and Germany, and the following table shows the number of cases of fresh and preserved eggs sent from Denmark to these two markets in the past two years:—

	England.		Germany.	
	1928.	1927.	1928.	1927.
Fresh	294,190	344,167	136,708	130,800
Preserved	103,524	102,862	10,399	6,731

The export of fresh eggs to the English market has fallen, while that of preserved eggs has remained unchanged. On the other hand, the export to Germany shows a rise in the quantity of both fresh and preserved eggs.

The Report concludes with the hope that when all the eggs imported into England bear a mark of origin, Danish eggs will come into their own again.

Irish Eggs on the Argentine Market.

A report by a Canadian Trade Commissioner on the question of the possibility of finding a market for Canadian eggs in Buenos Aires, which he describes as " the most potential egg market south of the equator," mentions incidentally that " Irish eggs have a very good name on the Buenos Aires market, so much so that it is possible in many cases to sell at sixpence above the competition." The Irish egg merchants are said to work on as small a profit as sixpence a case.

The Future of Pig Production in Germany.

The German Prices Research Institute, in a report on conditions on the German pig-market in 1928, gave a forecast of what might be expected in 1930. In their opinion, good prices might be expected in the near future, but all the information to hand, and especially the fact of the present increase in production, points to the likelihood of a change in the favourable conditions now prevailing. Conditions on the pig-market in 1930 would be governed by the action taken by breeders in the latter half of 1928 and during 1929. That action has been influenced by the prevailing favourable state of the pig industry and has naturally resulted in increased production. There has been an increase in the number of sows of 1 year old and upwards from 1,145,195 on 1st June, 1929, to 1,207,460 on 2nd September. During the same period, the number of bonhams under 8 weeks old increased from 4,160,221 to 5,372,084.

The Prices Institute stated, finally, that it was not yet possible to determine in which month of 1930 the supply of pigs would reach such proportions that the prices obtained would no longer cover the cost of production, but in any case, unfavourable conditions might be expected to prevail in the second half of the year 1930.

The fact that the German pig industry has hitherto failed to organise an export trade in bacon was commented on by a writer in a leading German daily. This correspondent stated that many German pig-breeders and feeders had been successfully producing light-weight pigs of the type required on the English market, but that, for one reason or another, the attempts at curing and exporting had met with but little success. Given sufficient capital, good technical equipment, and sound management, he was however, of opinion that a successful bacon industry might be started in Germany, with the view, of course, of organising an export trade. The Government too were said to be studying the whole question, and might decide to re-open, on a sounder basis, a certain bacon factory which became bankrupt, chiefly owing to unskilled management.

Danish Butter Trade Statistics, 1928-29.

The 26th Annual Report on Danish butter prices states that the total production of butter in Denmark between April, 1928, and March, 1929, was something like 163,000 tons, whilst the total export amounted to

146,000 tons, as compared with 142,000 tons in the preceding year. The export in 1928-29 was distributed as follows over the twelve months:—

April,	1928	7.3 per cent.
May,		8.9
June,		9.6
July,		9.2
August,		9.0
September,		7.8
October,		7.8
November,		8.7
December,		7.6
January,	1929	8.3
February,		7.7
March,		8.1
		100.0 per cent.

The geographical distribution of Denmark's butter export in 1928-29 was as follows, the corresponding figures for 1913 being also given, when available:—

	1913.	1928-29.
Great Britain	93.3%	67.8%
Norway	—	0.2
Austria	4.9	—
U.S.A.	—	0.2
France	—	0.4
Germany	1.4	27.5
Switzerland	0.3	2.8
Belgium	—	0.1
Other countries	0.1	0.3
Tinned butter	—	0.7
	100.0%	100.0%

French National Egg-Laying Competition.

This series of competitions was begun in October, 1920, and is still proceeding. The rules and conditions are as follows:—

The competition lasts for 12 periods of 4 weeks, at the end of which the awards are made. The birds which receive first and second prizes remain, however, under observation for another month, with a view to the accurate computation of the annual records.

The competition is organised to receive at least 100 pens of 5 birds each. 60% of the places are reserved for birds of French breeds. In response to the wishes of several breeders, it was decided to increase the number of pens which may be entered by any individual from 2 to 3, provided the birds are of the same breed and variety.

During the 11th period of the 8th national egg-laying competition held at Versailles (19th July to 18th August, 1929), 3 pens of 5 birds laid 100 or more eggs. They were:—

Black Bresse	...	127 eggs.
White Leghorn	...	110 ,,
,, ,,	...	101 ,,

At the end of this period, the classification by pens worked out as follows:—

			Number of eggs.
White Leghorn	...	...	1,142
,, Wyandotte	...	...	894
Black Bresse	...	...	905
Bourbourg	...	...	905
Rhode Island	...	...	831
Faverolles	...	...	768
Gâtinaise	...	...	818
Géline de Touraine	...	...	719
Gasconne	...	...	587
Australorp	...	...	550
Ducks.			
Khaki Campbell	...	...	1,027
White Indian Runners		...	721
Rouen	...	...	537

New French Law for Improvement of Wheat Trade.

The new Law for the regulation of the French wheat trade, passed in December, 1929, is designed to raise the price of home-grown wheat and to relieve the congestion of the home market which had been over supplied with foreign wheat. Very extensive powers are given to the Minister of Agriculture who may fix, by Decree, the minimum percentage of home-grown wheat to be incorporated in flour intended for bread-making. This percentage has actually been fixed at 97 per cent., which will have the effect of temporarily shutting down the import trade in wheat.

The regulations for the temporary admission of foreign wheat, under the laws of 1902 and 1912, are tightened up, the importer being obliged to re-export, within three months, a quantity of flour equivalent to the quantity of wheat imported. The exportation of existing stocks of foreign wheat is facilitated by a scheme for the refunding of import duty on such wheat if it is exported within three months of the passing of the Law. In this way it was hoped to relieve the French market of over 290,000 tons of foreign wheat.

The new Law further empowers the Government, even when the Chambers are not in session, to issue Decrees raising the import duty, not only on wheat,

but also on hops, potatoes, potato starch, wines, cattle, meat and dairy produce.

Finally, the Law provides for the repeal of the measure passed in 1922 prohibiting the use of wheat as a feeding stuff for live stock.

Appeal to German Potato-Growers.

A number of important organisations interested in the potato trade have issued an appeal to the German potato-growers in which they state that the days when inferior table potatoes were accepted by the consumer are now definitely past, thanks to the housewife's determination to buy only potatoes which meet her wishes in regard to size, cleanliness and grading. The housewife judges potatoes from their outside appearance, and an ever-increasing import of foreign potatoes is the result.

This importation might be checked if the German farmers would supply potatoes graded and sorted like those which come from abroad. Potatoes must not only be free from disease, but all small, double-grown, scabby, wormy or mouse-eaten tubers must be carefully sorted out. Potatoes should be well dried out before being sold, and any which show signs of internal decay should be picked out. Potatoes should be carefully handled before and during loading; sharp-edged tools should not be used. Railway trucks should be closely examined, and up-to-date methods of packing, ventilation, etc., are absolutely necessary.

Careful observance of these simple rules will bring about an increase in the sale and price of German potatoes, but neglect of them will mean an increased import of foreign potatoes.

Latvian Butter Exports, 1929.

According to the Latvian Press Bureau in London, butter exports during 1929 showed a considerable increase as compared with 1928. In the latter year 13 million kilos. of butter, valued at 52 million lats, were exported, whereas last year 15.1 million kilos. were shipped abroad. (52 mill. lats= approx. £2,100,000).

The value of butter exported during the last seven years amounts to about 260 million lats, or approximately £10,400,000, representing 630,600 metric tons, or 1,237,010 barrels.

Finances of German Agriculture.

Whilst some German farm holdings are still heavily burdened with debt and the load of taxation resting upon German agriculture at the close of 1928 amounted to over 52 millions sterling, or 12½ millions more than it was in 1913, there is reason to know that the owners of other farms have found themselves able once more to accumulate savings, though these savings have not yet reached the pre-war figure. According to returns made by the two great co-operative organisations in Germany, the Imperial Union (Reichsverband) and the Central Raiffeisen Union, the total amount of savings deposits and current-account deposits on their books at the

close of 1928 was over 67 millions sterling, an increase of 19 millions on the previous year. Of this sum, rather more than 51½ millions represent actual savings. The following figures indicate the recovery which has been made in the past five years in the deposit balance in the hands of the Reichsverband and the Raiffeisen Union. The 1913 figure is given by way of comparison.

End of year	1913	...	...	£120,550,000
,,	1924	...	...	£7,850,000
,,	1925	...	...	£20,400,000
,,	1926	...	...	£36,350,000
,,	1927	...	...	£48,100,000
,,	1928	...	...	£67,300,000

This balance must not, however, be taken as a measure of the savings capacity of the agricultural population, as not more than 60% of the customers of the agricultural co-operative societies are actually farmers, the remainder being tradesmen, teachers, clergymen, land workers, officials and other members of the rural population generally. Of the £51,700,000 invested, probably only one-half consists of savings, so that we arrive at some 25 to 30 millions stg. While in the pre-war period, the savings of the farmer about equalled his short-term indebtedness, the debts at present far exceed the invested savings. The building up of the deposit business by the agricultural co-operative societies shows, however, a satisfactory development, which is all the more admirable in that the satisfying of agricultural credit needs becomes increasingly possible to the organisations which had the largest share in the granting of credit before the war. The self-financing of agriculture is therefore progressing. Recourse to the central credit institutes has in fact materially fallen off in 1928.

Potato Wart Disease Legislation in Belgium.

Owing to the discovery of new centres of Potato Wart Disease (Synchytrium endobioticum) in Belgium, the Minister of Agriculture, by a Decree of 30th November, 1928, modified the provisions for the interior sanitary measures with regard to this disease as follows:—

Any producer or holder of potatoes who ascertains the presence of wart disease among his crops or stores shall immediately report the matter to the Burgomaster of the Commune. The latter will inform the Minister of Agriculture by telegraph.

Potato tubers grown in a district which the Phytopathological Service Inspector declares to be infected with wart disease, must not be removed from the district when raw. Potatoes grown within a radius of 500 metres of the area declared infected must not be lifted or transported without authorisation by the Inspector.

Storage and cultivation of potatoes within the infected zone or within a 500 metres radius of it are forbidden. The Phytopathological Service may extend the prohibition to include other crops where their storage or cultivation is liable to cause the spread of wart disease. The

Phytopathological Service Inspector may allow derogations from the preceding regulations, in particular for purposes of research or for cultivation of varieties known to be immune to wart disease.

Infringements of this Decree will be punishable under the provisions of Art. 21 of the Royal Decree dated 2nd September, 1922. In cases, where the application of these regulations shall have caused serious loss to farmers, the Minister of Agriculture may grant compensation.

Central Office of Agricultural Credit in France.

The Central Union of Agricultural Syndicates and the Agricultural Society of France have just established a Central Office for Agricultural Credit. This office will be a centre of information for economists and statisticians as well as for free agricultural credit institutions, keeping them informed of any legislation, decrees, circulars and judicial orders which may affect them. It will keep watch lest any custom become established or law passed contrary to the interests of agricultural credit.

The Central Office of Agricultural Credit is constituted under the law of the 1st July, 1901, which regulates what are described as the "disinterested Associations." It is in no sense a banking organisation which might arouse misgivings in banks anxious to maintain their complete independence.

In a word, the Central Office of Agricultural Credit will, without overlapping with existing bodies, be the centre of study and of the defence of the interests of agricultural credit, and its sole care will be the development of agriculture by means of credit.

Plans to Develop the Danish Butter Industry.

A German agricultural economist, Herr Bollert, has recently made a tour of Northern Europe and has published his impressions in the "Berliner Tageblatt." Of Denmark he says: "she is the world's largest butter exporter, supplying more than one-third of the world's total needs. New Zealand comes far behind with 18%, and Holland with 9%. . . . She is the world's second largest bacon exporter; the United States produces 40%, Denmark 25%, and Holland 10% of the world's bacon supply. . . . She is also the world's second largest egg exporter; China comes first with 25% of the total supply, Denmark second with 15.4%, and Holland third with 8.8%." These and other figures, says Herr Bollert, indicate the economic importance of Denmark.

Thanks to the efficiency of Danish methods, the cost of butter-production there has been reduced to a relatively low figure. The working costs per 1,000 kg. of milk are now about 15s. 1d., as compared with £1 14s. 9d. in the dearest period. None the less, the recent heavy drop in butter prices is threatening Danish national economy at its very core. The Danes are accordingly working out a scheme for still further improving the quality of their export butter. The feeling prevails that the present state of affairs on the world's butter markets affords a favourable opportunity for opening up fresh markets and for adding to the number of

customers on existing markets. In particular, it is believed that the English and German markets for Danish butter can be greatly extended. All the same, there is a feeling of anxiety in regard to the future. As a Danish trade paper puts it: " The State itself must realise that we are face to face with the final decision as to our very existence, and that as regards the establishment of an Institution for the promotion of the Danish Export Butter Trade, the hands of the clock are standing at 1 minute to 12."

Danish hopes of an extended sale in Germany are based on low costs of production and upon the fact that the sales of Danish butter in that country are 11% greater than they were in 1915. In this connection, it has been stated in Denmark that " things being as they are, we may calmly continue to increase our output of butter, for if we do not keep pace with the increased consumption in England and Germany, we may be sure that other countries will take our place, and if we are once forced off any market, recovery of the lost ground will be very difficult." The fact that the cost of production of first-class butter is much higher in Germany than it is in Denmark gives further ground for the hope that trade will be extended.

On the other hand, at the annual meeting of the German Dairying Union, it was stated that contracts with large consumers in Germany usually fell through owing to the inferior quality of the German butter, and the same speaker added: " I know of no firm in Southern Germany capable of supplying regularly on demand two truck-loads of butter of even quality, but any agent could fill such an order readily from Holland or Denmark."

Increased Area under Sugar Beet.

According to a statement issued by the International Institute of Agriculture, the total area under sugar beet in Europe (excluding Soviet Russia) shows a slight increase as compared with last year. Increases are recorded from Germany, Austria, France, Czecho-Slovakia, Sweden, the Irish Free State, Bulgaria, Latvia, and Rumania, while decreases are reported from Holland, Belgium, Hungary, Italy, Poland, Switzerland, and Yugoslavia. Soviet Russia shows a large increase, amounting to over 800,000 acres. The sugar beet area in Canada is practically the same as it was last year, but the United States show an increase of 13 per cent.

The area for all sugar beet producing countries, excluding Soviet Russia, exceeds that of 1929 by 4 per cent., and exceeds the five years' average (1924-28) by 6 per cent.

Reports for the second week in September show that the average sugar content of this year's crop in the following countries was: Germany 16.10 per cent.; France 16.73 per cent.; Czecho-Slovakia 16.60 per cent; and Finland 14.35 per cent.

Pig-Breeding and Bacon Production in Estonia.

On 26th March, 1930, the Estonian Parliament passed a law, the object of which is to establish a fund for promoting the pig industry and for stabilizing bacon prices. For the purpose of the fund, the State intends

to collect, during five consecutive years beginning with 1930-31, a sum of 2.50 Kr. (2s. 10d.) on every bacon pig exported. Furthermore, on every such pig, a sum of .90 Kr. (about 1s.) must be paid out of the Sales Tax on abattoirs, and finally the four existing export abattoirs must pay to the State for every bacon pig a contribution, the amount of which will be fixed by the Government but must not exceed 3.60 Kr. (about 4s.).

Of the moneys so collected, 40% will be set aside for promoting the pig industry, and the balance will be utilised for the stabilization of bacon prices. This will be effected by means of a State subsidy to breeders, as soon as the price for Estonian bacon of first quality falls below a normal price to be determined by the Government. The subsidy, which will only be granted for the best sort of bacon pigs, will not be paid out until 6 months after the Law comes into force. The passing of this Law was effected in consequence of the decline in the numbers of pigs in Estonia, and of the quantity of bacon exported. In 1927, the amount of bacon exported was about 2,550 tons; in 1928 this figure had fallen to 1,862 tons, and in 1929 to 1,274 tons. Since then, the situation has not improved, as is shown by the fact that in each of the four export abattoirs, the number of pigs killed is only about 75 to 80 per week.

Exports of Butter from the Baltic States.

The exports of butter from Estonia in 1929 amounted to 244,216 casks, as against 220,383 casks in 1928. In January, 1930, 7,100,000 kg. of butter were exported, as compared with 3,700,000 kg. in the same month last year, a very considerable increase. From Latvia, 1,205 tons of butter were exported in January, 1930, as compared with only 510 tons in the previous year. The total shipment of butter from Latvia in 1929 was 296,582 casks, or fully 15 million kilos, as compared with 13 million kilos in 1928. From Lithuania, 4,084 tons of butter were exported in 1929, as against 2,651 tons in 1928.

As Finland and Sweden are also exporting increasing quantities of butter, and Denmark, as usual, is going slowly but steadily forward, it would appear that all the countries surrounding the Baltic Sea, Russia excepted, are developing their dairy industry and steadily increasing their butter exports.

Eliminating the Second-Grade Egg.

The problem of the second-grade egg was recently discussed by the well-known Danish poultry expert, Dr. W. A. Kock. This grade of eggs, known in Denmark as "sekundas," is a source of much loss to the industry. It includes not only eggs which are not fresh, but also dirty eggs, washed eggs, and eggs which have been slightly damaged by hatching, heat or any other cause. Such eggs may not be exported from Denmark and they do not, of course, realise the top price even on the home market.

In their efforts to restrict the production of "sekunda" eggs, and to ensure that all such eggs are suitably stamped, the Danish Ministry of Agriculture issued an Order on 21st March, 1930, extending inspection (which had hitherto only applied to export eggs) to eggs supplied from egg societies, collectors, dealers, and co-operative stores to exporters, wholesalers, collect-

ing stations or warehouses. The order came into force on 15th May. All such eggs are in future to be delivered sorted in cases marked respectively "prima" and "sekunda," and are now subject to official inspection.

Dr. Kock said that if Denmark wanted to meet competition more successfully and make the poultry industry more paying, her egg-producers must in their own interests adopt "the simple measures which are necessary to eliminate the second-grade egg and to produce only new-laid first quality commercial eggs."

The production of clean eggs, said Dr. Kock, is a most important matter, as the washing of eggs is destructive of quality and keeping capacity. The hen-house must be kept clean and the floor covered with a thin layer of dry grit or sand, and plenty of litter. The upper surface of the ground outside the hen-house must be frequently scraped off and replaced by grit. Nests must not be set in heated places nor exposed to the sun. They must be kept free of droppings and be plentifully supplied with clean, dry straw, rush mats (which can be washed and sun-dried) or dry sand. The nesting material must be often renewed, particularly in warm weather, and also as a preventative of parasites, e.g., fleas, which cover the eggs with little black spots. If the number of nests is too small, several hens will lay in the same nest and the eggs will be soiled and broken, or the hens will lay astray. A broad board sprinkled with dry sand should be fixed before the nests so that the hens may enter the nest with clean feet. Steps should be taken to prevent hens from remaining in the nests at night. The use of trap nests means cleaner and fresher eggs. Neither ordinary eggs nor strongly-smelling camphor or naphthaline eggs should be used as nest-eggs. Hens inclined to sit spoil the quality of eggs lying in the nest. Such birds should at once be placed in the broody coop and fed plentifully, to bring them again to laying.

As non-fertile eggs keep much better than those which have been fertilised, hens kept for laying should not be run with a cock. Good commercial eggs should have reasonably thick shells, as this makes them stronger and heavier, and increases the keeping quality. Too much animal food, and the use of decaying food material will have a bad effect upon the flavour, smell and colour of eggs. Eggs should be collected several times a day, especially in warm or frosty weather. They should be stored in a place which is dry, cool and airy but not draughty. They must not be placed near any strong-smelling article. Heat, sunlight, and moisture are highly injurious to the quality of eggs, and cases should be well covered during transport.

Sprain or Internal Rust Spot of Potatoes.

Sprain, or internal Rust Spot, a well-known and widely-distributed potato disease, known in Yorkshire as "Canker," occurs in a virulent form in certain areas where the soil is a light sand very deficient in organic matter. The same soil yields badly scabbed crops in cases where lime has been freely applied.

Crops which are severely attacked by sprain become greatly depreciated in value when stored until the end of the year, and a month or two later

they may be unsaleable. In a series of variety trials carried out at the University of Leeds Department of Agriculture, in 1925, some varieties (e.g., Golden Wonder, Bishop and Field Marshal) proved very susceptible to the disease; others (e.g., King Edward, Great Scot) were less susceptible, and some (e.g., Resistant Snowdrop, Catriona and Majestic) were highly resistant.

Experiments carried out in 1926 and repeated in 1927 indicated that some reduction of the disease was brought about by heavy dressings both of Sulphate of Potash and Sulphate of Ammonia, but on the heavily infected land in question, this reduction was not sufficient to be worth considering. A similar inhibitory effect was produced by ground lime when applied in very heavy dressings and to a still lesser extent by a cresylic acid mixture. Flowers of sulphur and superphosphate of lime exerted practically no control of the disease. On the other hand, green-manuring, that is the ploughing in of a green crop before planting the potatoes, proved highly successful in warding off the disease. In the 1927 crop grown under this treatment only the slightest infection appeared even when the potatoes had been stored till the end of March. Green manuring as described may therefore be strongly recommended as a preventive measure against sprain or " Canker."

Control of the Beet Fly.

The beet fly caused serious damage last year in several parts of France; and plants were attacked by the pest in at least five Departments in the North of France. The pest has also been active in Germany since 1923, when it appeared in swarms in the Province of Silesia. It has since spread much in a southerly and south-easterly direction.

The fly lays its eggs in the Spring on the under-sides of the leaves of the beet plant. The larvæ burrow between the two skins of the leaf, causing the latter to wilt and die. Inside the leaves, the larvæ develop into pupæ, and these become adults in less than a fortnight. Three generations of flies are produced each year. When winter comes, the larvæ bury themselves in the earth, change into pupæ, and the cycle begins again in the following Spring.

In order to check the spread of the pest, the following measures have been suggested: change of crop, deep ploughing in autumn, close sowing, the use of suitable fertilisers to promote rapid growth in young plants, destruction of parasite plants at thinning; and spraying with suitable mixtures. General remedies are, however, not sufficient, and no method of destroying the flies of the first generation has yet been found. Experiments, more or less unsuccessful, were made with different spraying materials, but without definite result.

Attacks directed against the second generation of flies met with more encouraging results, partly because these flies tend to remain in the beet fields, where they find plenty of food, as the beet plants are now fully developed. A solution containing 2 per cent. of sugar and 0.3 to 4 per cent. of fluoride of sodium or fluorsilicate of sodium was applied in Germany to about 2,500 acres of beet, with good effect.

Ireland's Economic Position.

According to a recent report of the "Institut für Konjunkturforschung," Ireland stands among the few countries which are not affected by the present world-wide economic depression. During recent months, the Irish economic position has generally maintained itself at a high level, and in some respects has even further improved. This is mainly attributable to the fact that the purchasing power of agriculture has risen. Prices of live stock and their produce have been steadier than the prices of feeding stuffs, which have fallen sharply. The prices of live stock have improved and the numbers exported have increased; further, the export of dairy products maintains a higher level than last year in spite of a fall in prices. Irish industry was also able to increase the export of its principal products, beer, and lately, tractors.

Other countries which are not affected by the general slump are, in Europe, Norway, Denmark, Sweden and France, and overseas, Chile and New Zealand. The reason for the exceptional position of these countries differs in each case, but it is partly due to the facts that the prices of exported produce have fallen less than the prices of imported goods, and the purchasing power of the home market has risen. The principal products of these countries still find markets capable of absorbing them, and the sharp fall in the prices of cattle food has reduced the cost of production.

IMPORTS OF ANIMALS INTO IRELAND FROM GREAT BRITAIN AND THE ISLE OF MAN.

The number of Animals Imported into Ireland from Great Britain and the Isle of Man during the Six Months ended 30th June, 1930, was as follows :—

Cattle	258 Stores.	9 Milch Cows.	2 Springers.
		6 Calves.	
Sheep	45 Stores.		
Pigs	18 Stores.		
Goats	1.		
Horses	128 Stallions.	567 Mares.	191 Geldings.
Mules	2.		

Return of the Number of Horses Exported from Ireland through Great Britain to the Colonies and Foreign Countries during the Six Months ended 30th June, 1930, showing the Ports of Embarkation in Ireland :—

Ports.	Six months ended 30th June, 1930.			
	Stallions.	Mares.	Geldings.	Total.
Belfast	—	23	58	81
Cork	—	2	10	12
Dublin	5	146	164	315
Dundalk...	—	1	—	1
Greenore	—	105	117	222
Waterford	—	186	146	332
Total	5	463	495	963

There were exported from Dublin 1 stallion, 303 mares, 205 geldings, 4 mules or jennets, and 102 asses (direct) to Antwerp, and 3 mares and 2 geldings (direct) to Oslo.

TABLES SHOWING THE EXPORTS

TABLE

RETURN of the NUMBER of ANIMALS EXPORTED from IRELAND to 30TH JUNE, 1930, showing the PORTS

Ports in Ireland.	Cattle.						Sheep.			
	Fat.	Stores.	Milch Cows.	Spring-ers.	Calves.	Total.	Fat.	Stores.	Lambs.	Total.
Irish Free State Ports :—										
Ballina ...	277	74	—	—	—	351	271	—	752	1,023
Cork	3,904	36,799	621	2,655	12,468	56,447	113	484	3,468	4,065
Drogheda ...	6,298	43	—	—	—	6,341	309	—	11,789	12,098
Dublin ...	70,754	78,270	15,478	791	5,275	170,568	47,131	—	95,613	142,744
Dundalk ...	4,182	685	1	1	—	4,869	247	—	3,034	3,281
Galway ...	11	773	—	—	—	784	944	—	229	1,173
Greenore ...	2,371	10,201	517	505	—	13,594	628	—	7,724	8,352
Limerick ...	467	3,584	—	—	—	4,051	30	—	54	84
Rosslare ...	—	—	—	—	—	—	—	—	—	—
Sligo	333	450	1	1	248	1,033	447	—	1,100	1,547
Waterford ...	11,187	22,041	30	702	6,124	40,084	2,861	—	4,735	7,596
Westport ...	57	—	—	—	—	57	—	—	—	—
Wexford ...	1,918	—	—	—	—	1,918	769	—	1,274	2,043
TOTAL ...	101,759	152,920	16,648	4,655	24,115	300,097	53,750	484	129,772	184,006
Northern Ireland Ports :—										
Belfast ...	13,046	34,366	6,707	1,305	120	55,544	6,830	1	16,024	22,855
Larne	64	19,012	7	229	244	19,556	—	—	1,507	1,507
Londonderry ...	7,371	34,795	393	526	11,194	54,279	1,037	1,178	3,905	6,120
Newry ...	957	654	5	8	—	1,624	218	—	640	858
TOTAL ...	21,438	88,827	7,112	2,068	11,558	131,003	8,085	1,179	22,076	31,340
All Irish Ports :—										
TOTAL ...	123,197	241,747	23,760	6,723	35,673	431,100	61,835	1,663	151,848	215,346

TABLE

RETURN of the NUMBER OF ANIMALS EXPORTED from IRELAND to 30TH JUNE, 1930, showing the PORTS of DEBARKATION

Ports in Great Britain and the Isle of Man.	Cattle.						Sheep.			
	Fat.	Stores.	Milch Cows.	Spring-ers.	Calves.	Total.	Fat.	Stores.	Lambs.	Total.
England and Wales.										
Bristol ...	548	6,838	16	360	1,551	9,313	220	—	41	261
Fishguard ...	3,290	31,012	628	2,886	9,707	47,523	367	370	989	1,726
Heysham ...	11,244	19,379	4,931	730	1	36,285	5,946	1,178	16,767	23,891
Holyhead ...	22,164	38,075	8,981	825	1,265	71,310	13,524	—	33,055	46,579
Liverpool ...	59,023	41,727	3,408	445	3,354	107,957	30,344	114	81,057	111,515
Manchester ...	6,282	2	2	1	—	6,287	4,144	—	2,419	6,563
Plymouth ...	—	—	—	—	—	—	—	—	—	—
Preston ...	11,496	1,272	3,407	103	56	16,334	7,142	—	14,459	21,601
Silloth ...	88	10,820	36	17	759	11,720	—	—	—	—
Scotland.										
Ardrossan ...	—	—	—	—	—	—	—	—	—	—
Ayr	224	13,089	142	175	40	13,670	32	1	80	113
Glasgow ...	8,643	41,114	2,148	957	17,789	70,651	86	—	1,474	1,560
Greenock ...	120	21,544	54	49	907	22,674	—	—	—	—
Stranraer ...	55	16,802	7	175	244	17,283	—	—	1,507	1,507
Isle of Man.										
Douglas ...	20	73	—	—	—	93	30	—	—	30
TOTAL ...	123,197	241,747	23,760	6,723	35,673	431,100	61,835	1,663	151,848	215,346

AND IMPORTS OF ANIMALS.

I.

GREAT BRITAIN and the ISLE OF MAN during the Six months ended
OF EMBARKATION IN IRELAND.

Pigs. Fat.	Pigs. Stores.	Pigs. Total.	Goats.	Horses. Stallions.	Horses. Mares.	Horses. Geldings.	Horses. Total.	Mules or Jennets.	Asses.	Total Animals.	Ports in Ireland.
											Irish Free State Ports.
2,116	—	2,116	—	—	—	—	—	—	—	3,490	Ballina.
47,554	—	47,554	—	4	62	129	195	—	12	108,273	Cork.
11	—	11	1	—	—	—	—	—	—	18,451	Drogheda.
40,741	27	40,768	23	106	818	700	1,624	3	36	355,766	Dublin.
73	—	73	93	—	3	2	5	—	—	8,321	Dundalk.
1,550	—	1,550	—	—	—	—	—	—	—	3,507	Galway.
6,303	—	6,303	16	—	350	425	775	—	6	29,046	Greenore.
57	—	57	—	—	—	—	—	—	1	4,193	Limerick.
—	—	—	—	—	8	4	12	—	—	12	Rosslare.
9,469	—	9,469	—	—	—	—	—	—	—	12,049	Sligo.
23,639	—	23,639	—	—	351	354	705	—	19	72,043	Waterford.
—	—	—	—	—	—	—	—	—	—	57	Westport.
5	—	5	3	—	—	—	—	—	—	3,969	Wexford.
131,518	27	131,545	136	110	1,592	1,614	3,316	3	74	619,177	TOTAL.
											Northern Ireland Ports.
6,874	269	7,143	2	11	460	848	1,319	7	14	86,884	Belfast.
856	2,852	3,708	—	1	4	29	34	—	5	24,810	Larne.
1,800	—	1,800	—	1	15	12	28	—	4	62,231	Londonderry.
20	—	20	—	—	—	—	—	—	—	2,502	Newry.
9,550	3,121	12,671	2	13	479	889	1,381	7	23	176,427	TOTAL.
											All Irish Ports.
141,068	3,148	144,216	138	123	2,071	2,503	4,697	10	97	795,604	TOTAL.

II.

GREAT BRITAIN and the ISLE OF MAN during the Six Months ended
in GREAT BRITAIN and the ISLE OF MAN.

Pigs. Fat.	Pigs. Stores.	Pigs. Total.	Goats.	Horses. Stallions.	Horses. Mares.	Horses. Geldings.	Horses. Total.	Mules or Jennets.	Asses.	Total Animals.	Ports in Great Britain and the Isle of Man.
											England and Wales.
331	—	331	—	—	10	11	21	—	18	9,944	Bristol.
56,409	—	56,409	—	2	389	443	834	—	7	106,499	Fishguard.
7,570	—	7,570	2	6	322	483	811	7	15	68,581	Heysham.
42,923	2	42,925	21	105	1,141	1,069	2,315	1	32	163,183	Holyhead.
27,227	—	27,227	115	4	59	55	118	—	6	246,928	Liverpool.
—	—	—	—	—	—	—	—	—	—	12,850	Manchester.
—	—	—	—	—	2	2	4	—	—	4	Plymouth.
1,590	—	1,590	—	—	—	2	2	2	—	59,529	Preston.
142	—	142	—	—	3	3	6	—	2	11,870	Silloth.
											Scotland.
—	—	—	—	4	56	181	241	—	—	241	Ardrossan.
173	369	542	—	—	5	23	28	—	—	14,353	Ayr.
3,856	—	3,856	—	1	59	180	240	—	5	76,312	Glasgow.
4	—	4	—	—	—	1	1	—	—	22,679	Greenock.
843	2,718	3 561	—	1	4	29	34	—	5	22,390	Stranraer.
											Isle of Man.
—	59	59	—	—	21	21	42	—	7	231	Douglas.
141,068	3,148	144,216	138	123	2,071	2,503	4,697	10	97	795,604	TOTAL.

IMPORTS of Horses into Ireland from the Colonies and Foreign Countries, either direct or through Great Britain, during the Six Months ended 30th June, 1930.

Name of Foreign or Colonial Port at which embarked.	Six months ended 30th June. 1930.			
	Stallions.	Mares.	Geldings.	Total,
New York via Liverpool for Dublin	—	1	—	1
New York via London for Dublin ...	—	6	5	11
Boulogne via Folkstone for Dublin	4	12	2	18
Lisieux via Folkstone for Dublin ...	—	2	—	2
Antwerp via Harwich for Dublin ...	—	12	3	15
Bombay via Liverpool for Dublin ...	—	1	2	3
Montreal via London for Dublin ...	—	1	—	1
Boston via Manchester for Dublin ...	—	1	—	1
TOTAL	4	36	12	52

DISEASES OF ANIMALS IN IRISH FREE STATE.

The following statement indicates the position with regard to contagious diseases during the quarter ended 31st March, 1930 :—

Anthrax outbreaks	—
Foot and Mouth Disease outbreaks	—
Glanders (including Farcy) outbreaks	—
Parasitic Mange outbreaks	8
Rabies outbreaks	—
Sheep Scab outbreaks	50
Swine Fever outbreaks	17
Swine slaughtered as diseased or suspected	123
Tuberculosis outbreaks	412
Animals declared affected	418

The following statement indicates the position with regard to contagious diseases during the Quarter ended 30th June, 1930 :—

Anthrax outbreaks	1
Foot and Mouth Disease outbreaks	—
Glanders (including Farcy) outbreaks	—
Parasitic Mange outbreaks	3
Rabies outbreaks	—
Sheep Scab outbreaks	13
Swine Fever outbreaks	23
Swine slaughtered as diseased or suspected	295
Tuberculosis outbreaks	588
Animals declared affected	594

QUARTERLY AVERAGE PRICES FOR EACH PROVINCE, AND FOR IRELAND, OF CROPS, LIVE STOCK, MEAT, PROVISIONS, &c., for the Quarter ended 31st March, 1930.

PRODUCT.	Leinster	Munster	Ulster	Connacht	Ireland
Crops—	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wheat ... ... per 112 lb.	0 10 3	—	0 11 1	—	0 10 4
Oats (White) ... ,,	0 6 9	0 7 0	0 6 4	0 7 6	0 6 11
,, (Black) ... ,,	6 6 0	0 6 7	—	—	0 6 1
Barley ... ... ,,	0 8 8	—	—	—	0 8 8
Potatoes ... ,,	0 3 8	0 3 5	0 2 1	0 3 4	0 3 0
Hay (1st & 2nd Years' Crop), ton	4 3 9	3 16 0	4 1 3	4 6 0	4 1 9
,, (Meadow) ... ,,	3 2 0	2 11 3	2 18 6	3 2 3	2 19 9
Grass Seed—					
Perennial per 112 lb.	—	—	0 15 4	—	0 15 4
Italian ... ,,	—	—	—	—	—
Flax ... ... per 14 lb.	—	—	0 8 7	—	0 8 7
Live Stock— per					
Calves, under 6 months head	3 6 9	2 13 9	3 3 6	3 5 3	3 0 0
Store Cattle—					
6 to 12 months ,,	8 1 3	7 12 9	8 1 0	7 15 9	7 17 0
1 to 2 years ... ,,	12 8 6	12 1 6	12 1 0	12 7 6	12 3 9
2 to 3 years ... ,,	16 7 3	15 2 9	14 17 0	16 6 6	15 14 0
3 years and over ,,	18 13 0	15 13 0	13 18 3 (c)	19 8 9	17 18 0
Fat Cattle—					
Under 2 years ,,	17 0 0	15 9 9 (d)	—	—	15 15 6
2 to 3 years ... ,,	20 5 9	18 4 9	18 11 0	17 19 9	18 18 6
3 years and over ,,	22 1 3	19 18 6	19 9 6	20 7 0	21 6 3
Cows and Bulls ,,	17 11 0	14 6 6	17 4 6	17 19 9	15 10 6
Springers (Cows and Heifers) ,,	20 17 9	19 1 3	19 15 3	19 8 6	19 15 3
Milch Cows (down Calved) ,,	18 17 6	18 6 0	17 17 6	17 11 6	18 4 9
Lambs, under 12 months ,,	2 6 9	2 14 9	1 18 0	2 3 3	2 10 3
Store Sheep—					
1 to 2 years ... ,,	2 6 9	2 17 9	—	2 19 9	2 12 3
2 years and over ,,	3 6 9	—	1 15 9 (e)	—	2 12 0
Fat Sheep—					
1 to 2 years ... ,,	3 1 6	3 14 0	2 13 0	3 8 3	3 7 9
2 years and over ,,	3 4 6	3 14 3	2 14 9	3 13 3	3 6 9
Young Pigs, under 12 weeks ,,	2 0 9	1 17 9	2 19 6	2 12 6	2 13 0
Store Pigs—					
12 weeks to 4 months ,,	2 17 3	2 12 3	3 10 6	—	2 15 9
4 months and over ,,	3 10 9	3 14 6	—	—	3 14 0
Meat, Provisions, &c.—	s. d.	s. d.	s. d.	s. d.	s. d.
(a) Beef (Live) per 112 lb.	46 9	—	—	—	—
,, (Dead) ... ,,	81 9	—	—	—	—
(a) Mutton (Live) ,,	59 3	—	—	—	—
,, (Dead) ,,	103 9	—	—	—	—
(b) Pork (Live) ,,	79 3	74 0	77 0	70 3	75 3
,, (Dead) ,,	105 6	98 9	102 6	93 6	100 3
Eggs ... ... per 120	12 5	11 4	11 4	11 6	11 10
Wool ... ... per lb.	0 10¾	—	—	—	0 10¾

(a) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio 7 : 4.

(b) The live weight price is to the dead weight price in the ratio 3 : 4.

(c) Second and third class cattle. (d) Second class cattle. (e) Chiefly Mountain Type.

Quarterly Average Prices for each Province and for Ireland, of Crops, Live Stock, Meat, Provisions, &c., for the Quarter ended 30th June, 1930.

Product.	Leinster			Munster			Ulster			Connacht			Ireland		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Crops—															
Wheat ... ... per 112 lb.		—			—			—			—			—	
Oats (White) ... ,,	0	6	11	0	7	0	0	7	2	0	9	2	0	7	4
,, (Black) ... ,,	0	5	11	0	6	2		—			—		0	6	0
Barley ... ... ,,		—			—			—			—			—	
Potatoes ... ,,	0	4	0	0	3	5	0	2	1	0	3	3	0	3	1
Hay (1st & 2nd Years' Crop), ton	4	7	3	3	15	9	3	14	9	4	12	3	4	1	6
,, (Meadow) ..	3	9	0	2	17	3	2	11	0	3	2	9	2	18	6
Grass Seed—															
Perennial per 112 lb.		—			—			—			—			—	
Italian ... ,,		—			—			—			—			—	
Flax ... ... per 14 lb.		—			—		0	8	4		—		0	8	4
Live Stock— per															
Calves, under 6 months head	3	11	6	3	2	3	3	13	0	3	15	9	3	8	6
Store Cattle—															
6 to 12 months ,,	8	8	9	8	5	9	8	8	0	8	1	0	8	6	9
1 to 2 years ... ,,	12	13	0	12	5	9	12	3	9	12	6	3	12	7	0
2 to 3 years ... ,,	16	0	6	15	3	9	15	6	6	15	14	6	15	11	6
3 years and over ,,	18	10	9	15	13	0	15	2	6	18	11	6	17	11	6
Fat Cattle—						(c)									
Under 2 years... ,,		—		15	14	3		—			—		15	14	3
2 to 3 years ... ,,	19	12	6	18	10	6	18	12	9	19	5	0	18	18	0
3 years and over ,,	21	14	3	20	8	0	19	4	3	20	0	3	21	6	9
Cows and Bulls ,,	16	18	0	13	12	0	16	3	0	17	19	6	14	16	0
Springers (Cows and Heifers) ,,	20	6	3	18	5	3	19	15	0	18	17	0	19	8	3
Milch Cows (down Calved) ,,	18	8	9	17	18	6	17	12	0	16	16	0	17	16	9
Lambs under 12 months ,,	2	2	3	2	5	6	2	2	6	1	16	3	2	2	6
Store Sheep—															
1 to 2 years ... ,,	2	9	3	2	16	3	1	19	9	2	9	3	2	11	0
2 years and over ,,	2	2	0 (d)		—		1	12	6 (d)	3	6	0	2	0	9
Fat Sheep—															
1 to 2 years ... ,,	3	0	9	3	12	0	2	11	3	3	4	0	3	4	6
2 years and over ,,	3	4	0	3	13	0	2	16	3	3	17	3	3	6	6
Young Pigs, under 12 weeks ,,	1	15	9	1	19	6	2	12	9	2	2	3	2	6	0
Store Pigs—															
12 weeks to 4 months ,,	2	9	6	2	4	3	3	7	0		—		2	7	9
4 months and over ,,	3	0	9	3	2	0		—			—		3	1	9
Meat, Provisions, &c.—		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
(a) Beef (Live) per 112 lb.		48	0		—			—			—			—	
,, (Dead) ... ,,		84	0		—			—			—			—	
(a) Mutton (Live) ,,		60	3		—			—			—			—	
,, (Dead) ,,		105	6		—			—			—			—	
(b) Pork (Live) ,,		63	3		62	6		59	3		60	6		62	0
,, (Dead) ,,		84	3		83	3		79	0		80	9		82	6
Eggs ... ... per 120		9	3		8	3		8	7		8	0		8	10
Wool ... ... per lb.		0	9		0	8¾		0	6⅛ (e)		0	7		0	8⅞

(a) The prices of Beef and Mutton are calculated from the reported prices per 112 lb. live weight of Fat Cattle and Fat Sheep sold in Dublin Cattle Market, the price per 112 lb. dead weight being to the price per 112 lb. live weight in the ratio 7 : 4.

(b) The live weight price is to the dead weight price in the ratio 3 : 4.

(c) Second class cattle. (d) Mostly Mountain Type.

(e) Mostly Unwashed Mountain Wool.

OFFICIAL DOCUMENT.

Thirty-seventh list.

AN ROINN TALMHAIOCHTA

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907, SECTIONS 8 AND 14 (1).

List of names approved by the Department for use in connection with Margarine:—

Arco.

Ascol.

Clifton.

Duchess.

Eureka.

Peachey's.

Rada.

Rado.

Silver Bloom.

Department of Agriculture,
Dublin, C.17.
30th June, 1930.

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The Loss of Vitality in Stored Farm Seeds—World's Poultry Congress 1930—Potato Growing for Seed Purposes—Seed Propagation 1930—Mid-Season Fruit Crop Report 1931—Field Experiments 1930—Sugar Beet Experiments 1930—Egg-Laying Competition 1929-30—Notes and Memoranda—Official Documents.

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THE LOSS OF VITALITY IN STORED FARM SEEDS.

By H. A. LAFFERTY, F.R.C.Sc.I.

The length of time during which seeds can remain alive in a passive condition is a problem that has received scientific attention for many years, but it has also attracted the mild sensation-monger with rather unfortunate results. Unauthorised and unscientific accounts of explorations in ancient tombs rarely fail to refer to the finding of "mummy wheat" in such locations, and some of these accounts have even gone so far as to suggest that seed of this nature has been found to be alive after a period of dormancy extending in some cases to thousands of years. The remains of "mummy wheat" and other grains undoubtedly have been found, from time to time, in ancient tombs, but there is no authentic record of such grains ever having been induced to germinate after their discovery. In all cases where such seeds were critically and scientifically examined they have proved to be dead, and their contents disorganised. Such results, however, need not necessarily prejudice us against the belief that certain varieties of seed, under particularly favourable conditions of storage, may retain their vitality for a very long time.

Within the past ten years Ohga[1] has reported the finding of viable "seeds" (fruits) of the Indian Lotus (*Nelumbo nucifera*) deeply embedded in peat deposits in Manchuria, and an examination of the situation in which they were found led him to the conclusion that they were at least 200 years old. Ewart[2] working on the germination of seeds of known age from herbarium specimens found that the seeds of certain varieties of plants retained their vitality after having remained in a dry condition for over 100 years. He suggested, however, 200 years as being the probable maximum for the duration of germinating power.

A considerable amount of data has been accumulated in recent years on the behaviour of certain seeds when exposed to varying conditions, but much experimental work remains to be done before our knowledge of the factors which operate for or against prolongation of life will be complete. It has been shown, for instance, that certain varieties of seeds can germinate after long periods of exposure to freezing, while others are uninjured by what must be regarded for active plant life as extremes of heat. Experiments have been carried out which show that by gradually applying dry heat to wheat grains the temperature of the heating apparatus may be raised to 100° C. for short periods without completely killing the grain. The present writer found, in his attempts to sterilise flax seed by dry heat, that the seeds of this plant could withstand a temperature of 96.5°C. for thirty hours without complete loss of life. Harrington and Crocker[3] found

(1) Ohga I.—On the Longevity of the Fruit of Nelumbo nucifera. Bot. Mag., Tokyo, 37 : 87–95, 1923.

(2) Ewart A. J., and White J.—On the Longevity of Seeds. Proc. Roy. Soc., Victoria, 21 : 1-210, 1908.

(3) Harrington G. T., and Croker W., Resistance of Seeds to Desiccation. Jour. Agr. Res. Vol. XIV., No. 12, 1918.

that the percentage of germination of Poa pratensis was not materially affected after the seeds had been dried in a vacuum oven for 6 hours at 100°C. It is interesting to note that in these and similar cases where seeds have been shown to withstand extremes of heat the seed itself underwent a process of desiccation during the operation, and it is generally believed that this gradual drying of the seed is the deciding factor in determining whether or not injury will result from the heat treatment. That moist heat is most injurious to certain seeds is now well known as a result of the vast amount of work that has been done in connection with the hot water treatment for sterilising Barley grains infected with "Smut," and the majority of the experimenters on this problem have found that while the vitality of seed of this cereal was not impaired by being immersed in water which was kept at a temperature of 52°C. for a short time, serious injury was almost sure to result if the temperature of the water bath was allowed to rise a few degrees higher.

To test the effect of certain dry gases and chemical solutions on the germination of Lucerne seed Giglioli[1] carried out a series of tests which extended over a period of approximately sixteen years. He found that, in some cases at least, the seed was able to survive under conditions which precluded any possibility of respiratory exchanges, a result which gains support from the work of Romanes and others who kept seeds in a vacuum for periods ranging from fifteen months to seven years without loss of vitality. Results such as these are, undoubtedly, of very great scientific interest, but they are of little economic importance to the practical farmer who wants to know, for instance, how long can weed seeds live when they are buried in the soil, or to what extent may he hold over his farm seeds from one year to the next without running the risk of serious loss of crop when they are sown.

Beal appears to have been the first to attempt to solve the weed seed problem. Using seeds of twenty species of plants, he enclosed samples of each in each of a series of wide-mouthed bottles which he afterwards buried in the ground. The bottles were so arranged that one could be taken up at intervals without disturbing the remainder, and since the experiment was begun one bottle has been lifted every five years, and germination tests made on the seeds which it contained. The last available report[2] of these investigations dealt with the contents of a bottle which had been buried for forty years, and of the twenty species of seeds which it contained ten showed a certain number which were still viable. In 1902 Duvel[3] began a somewhat similar experiment, but he used seeds from 107 species of plants, and he also varied the depths to which they were buried. The seeds were mixed with sterilised soil and placed in flower pots, which were then buried in a pit in the soil. The pit was so arranged that the pots

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(1) Nature. Oct. 3, 1895.

(2) Darlington, H. T., Dr. W. J. Beal's Seed-viability Experiment. Amer. Jour. Bot. 9: 266–269, 1922.

(3) Duvel, J. W. T.—Vitality of Buried Seeds. U. S. Dept. Agr. Bur. Plant Indus. Bul. 83, 1905.

were placed at three different levels, namely—eight inches, twenty-two inches, and forty-two inches below the surface. At frequent intervals since this experiment was begun a complete set of pots has been lifted, and the seeds contained in them tested for germination. The last available report [1] of these investigations deals with the series which was examined in 1923, and it shows that after twenty years seeds of fifty-one species of plants still showed a certain percentage of germination. It is not surprising to find it stated in the report referred to that a certain percentage of the seeds of many of the Clovers were able to germinate or still remained "hard" after all these years, nor yet to find that such seeds as Oats and Meadow Fescue were long since dead, but it is interesting to note that in the case of Poa pratensis (Smooth Stalked Meadow Grass) and Phelum pratensis (Timothy) a small percentage of the seeds of these grasses was still alive after twenty years. The author of the report states in his summary that "the seeds of weeds or wild plants survived better than cultivated plants," and further that "the weeds showing the highest germination and fewest failures were all from common and persistent weeds of the locality." The results of this experiment support the common belief that in ordinary farm practice the seeds of certain weeds, as for instance Charlock, can remain dormant in the soil through at least an entire seven course rotation period, and it also shows the futility of attempting to destroy such weed seeds by ploughing them under.

From articles which have appeared in recent years it is clear that towards the end of the nineteenth century certain seed specialists, notably Dorph-Petersen and Eastham, had turned their attention to the question of the longevity of agricultural seeds under, what we may term, ordinary conditions. While these and other workers were engaged in their researches, but before their results had been published, this matter was taken up by Dr. Pethybridge, Head of the Department's Seed Testing and Plant Disease Division, who began a series of investigations which, on his subsequent retirement, were passed over to the present Director of the Seed Testing Station for completion. This work has now been brought to a conclusion, and as Dr. Pethybridge very kindly placed at the writer's disposal his earlier results it is now possible to treat this investigation as a whole. The following account deals with the scope of the work and some of the results obtained.

During the Autumn and Winter months of the year in which these trials were commenced, samples of the commoner agricultural seeds were selected for experimental purposes. The original intention was to include each variety of seed in duplicate, and in this way to determine the rate of loss of vitality of a sample of high germinating power and also of one whose percentage of germination was low. This procedure was followed in most cases, but as time went on the results obtained suggested that many of the seeds with a low percentage of germination were old, consequently their

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(1) Goss, W. L.—The Vitality of Buried Seeds. Jour Agr. Res. Vol. XXIX., No. 7, 1924.

behaviour was not comparable with that of freshly harvested seed of high quality, and for that reason the results obtained from these old seeds have not been considered in this report. The selected samples, after having been tested for germination, were placed in paper sample bags, and stored at room temperature in glass-fronted cupboards in one of the working Laboratories. Each Spring these seeds were tested for germination, and this procedure was continued until all the seeds of a particular lot were dead or, as happened in a few instances, until they were all used in making the germination tests. The complete results are shown in Table I. herewith.

[TABLE.

TABLE I.

SHOWING THE ANNUAL PERCENTAGE OF GERMINATION OF SEEDS WHICH WERE STORED IN PAPER BAGS IN THE LABORATORY.

Variety of Seed.	PERCENTAGE OF GERMINATION.															
	Original Test.	After 1 Year.	After 2 Years.	After 3 Years.	After 4 Years.	After 5 Years.	After 6 Years.	After 7 Years.	After 8 Years.	After 9 Years.	After 10 Years.	After 11 Years.	After 12 Years.	After 13 Years.	After 14 Years.	After 15 Years.
Oats	72	76	72	74	74	64	24	8	1	0	—	—	—	—	—	—
Barley	99	96	90	86	60*	—	—	—	—	—	—	—	—	—	—	—
Perennial Ryegrass ...	81	79	66	58	58	55	37	31	15	3	0	—	—	—	—	—
Italian Ryegrass ...	94	96	97	91	94	92	90	85	78	69	42	22	9	0	—	—
Meadow Fescue	92	73	61	36	39	22	12	4	1	0	—	—	—	—	—	—
Meadow Foxtail	64	44	36	30	31	18	12	7	2	1	0	—	—	—	—	—
Timothy	97	91	88	73	63	54	44	29	5	0	—	—	—	—	—	—
Cocksfoot	79	67	51	45	31	29	23	11	6	2	0	—	—	—	—	—
Red Clover	94+5	75+12	33+4	22+2	15+5	5+3	7+3	5+1	1+3	1+4	1+4	1+5	0+3*	—	—	—
White Clover	96+1	99+0	77+1	71+0	64+2	56+1	50+1	43+1	30+1	25+1	18+1	6+2	2+0	1+1	0+0	—
Alsike Clover	79+11	68+12	53+9	55+5	30+11	15+7	19+6	16+8	10+6	11+7	2+8	6+8	5+9	3+7	2+4	1+4*
Swede	92	92	94	89	84	78	61	60	29	10	0	—	—	—	—	—
Flax	95	86	86	86	79	70	78	67	73	43	25	1	1	0	—	—

* All seeds in sample used.

As the results obtained from these tests are self-explanatory it will not be necessary to discuss them at any great length. In examining them, however, it must be remembered that each variety of seed is represented by one sample only which was confined to one set of storage conditions, consequently one must not attempt to generalise from them or to hazard a guess as to what might have happened if each variety of seed had been represented by several different samples and the conditions of storage altered. One can state, definitely, however, that under the very favourable conditions of storage which prevailed, the seeds used in these trials were comparatively short lived, and further, that the rate of loss of vitality was not directly proportional to their age. In the case of almost every variety the general result has been the same, namely, a small but gradual decrease in the percentage of germination for the first few years, followed by a series of rapid decreases which continued until the seeds were dead or almost completely so.

In some quarters there is an idea prevalent that the germination of agricultural seeds is in some mysterious way intimately bound up with seasonal changes, and when discussing the pros and cons of an unsatisfactory sample, taken in early Spring under the Weeds and Agricultural Seeds (Ireland) Act, 1909, and tested, say, in the following July or August, it is not unusual to find oneself confronted with the suggestion that since Spring is the normal time for seeds to germinate in the soil, if they are not sown then they become semi-dormant and refuse to germinate freely even under artificial conditions until the following Spring. Since the only satisfactory way of dealing with such claim is to put the matter to a critical test, the following trials were carried out with that object in view.

It is well known that Rye is one of those seeds which deteriorates as a rule fairly rapidly during its first Summer in storage, and, on this account, it was selected as being a suitable variety of seed to use in the initial test. A sample of high-grade Imported Essex Rye was tested for germination and afterwards stored in a paper sample bag in the Laboratory. At frequent intervals throughout a period of one year the sample was tested for germination, and the results obtained are shown in Table II.

TABLE II. showing the percentage of germination of a sample of Rye stored in the Laboratory and tested at intervals throughout a period of one year.

Date of Test.	Percentage of Germination.	Date of Test.	Percentage of Germination.
26/10/15	95	5/ 2/16	93
8/11/15	90	30/ 3/16	91
18/11/15	94	14/ 6/16	89
29/11/15	92	24/ 7/17	81
9/12/15	93	4/ 8/16	80
3/ 1/16	95	22/ 8/16	82
10/ 1/16	91	22/ 9/16	84
21/ 1/16	92	16/10/16	80

A glance at the results in the foregoing table shows that after approximately five months the germinating power of this sample of Rye began to decrease, and, for all practical purposes, this continued throughout the remainder of the trial, and amounted to a total loss of 15% by the end of the year. By this time all the seed had been used, and as the trial had only continued throughout one Spring it was considered advisable to repeat the test with the following modifications.

A sack of Rye of high quality (approximately one hundredweight) was stored under good commercial conditions on a Dublin seed merchant's premises, and, from time to time, the seed was sampled and tested for germination. In this case the trial continued for a period of two years, and the results obtained are shown in the following table:—

TABLE III. showing the percentage of germination of a small bulk of Rye stored for two years under good commercial conditions.

Month of Test.	Percentage of Germination.	
	First Year.	Second Year.
November	93	—
December	89	56
January	84	57
February	76	47
March	63	44
April	64	47
May	63	...
June	57	33
July	53	31
August	57	23
September	60	28
October	52	27

From the results which appear in Table III. it is clear that the rate of decrease in the percentage of germination was much greater than in the case of the smaller sample of Rye grain which had been stored under Laboratory conditions, but apart from this difference the behaviour of the seed was very similar in both trials. It is of particular interest to notice that the decrease in the percentage of germination continued throughout the duration of the trial, thereby proving that in the case of Rye, at least, the suggestion of seasonal fluctuation in germination was completely erroneous.

As this theory has frequently been put forward as applying particularly to the seeds of the Ryegrasses, the following trials were carried out with a sample of new crop Perennial Ryegrass seed (28lb. per bushel) and with a sample of new crop Italian Ryegrass (20lb. per bushel). Both samples were stored in seed envelopes in the Laboratory, and the seed was tested for germination at intervals. During the first year the tests were made fortnightly, but during the second year the intervals were extended to one

month, and in the last two years the tests were made at irregular intervals. The four years' results are shown in Table IV.

TABLE IV. showing the percentage of germination of two samples of Ryegrass seed determined at frequent intervals over a period of four years.

Date of Test.	Perennial Percentage of Germination.	Italian Percentage of Germination.	Date of Test.	Perennial Percentage of Germination.	Italian Percentage of Germination.
8/ 1/24	89	90	20/ 3/25	85	91
6/ 2/24	89	90	15/ 5/25	80	88
20/ 2/24	90	87	13/ 6/25	80	87
5/ 3/24	85	91	22/ 7/25	81	86
19/ 3/24	88	85			
2/ 4/24	90	91	27/ 8/25	82	84
16/ 4/24	88	88	16/ 9/25	87	92
30/ 4/24	89	88	27/10/25	84	86
14/ 5/24	87	89	10/11/25	86	86
28/ 5/24	86	89	2/12/25	82	89
11/ 6/24	84	91	8/ 1/26	83	83
			25/ 5/26	76	84
25/ 6/24	85	86	30/ 6/26	75	83
9/ 7/24	91	90	17/ 7/26	74	80
23/ 7/24	85	89	15/10/26	77	79
6/ 8/24	86	89	2/11/26	78	82
20/ 8/24	85	91			
3/ 9/24	87	91	8/12/26	79	80
17/ 9/24	85	92	10/ 1/27	77	83
1/10/24	87	90	20/ 2/27	72	82
15/10/24	85	87	8/ 3/27	67	71
29/10/24	85	88	24/ 4/27	68	77
12/11/24	85	88	6/ 6/27	66	75
26/11/24	88	88	12/ 7/27	61	73
10/12/24	83	90	8/ 9/27	55	71
16/ 1/25	84	89	12/11/27	62	76
17/ 2/25	82	84	14/12/27	57	77

An examination of the results shown in Table IV. fails to reveal any evidence whatever of seasonal fluctuations in the germination of these seeds. Occasionally a test will be found giving a slightly higher germination result than its predecessor, but where this happens it does not imply that the seed has improved in the interval between the tests, but merely indicates normal variations which arise from sampling, etc. Results such as these must be examined as a whole, and if this is done in the cases under consideration it will be clear that the tendency was for both lots of seed to deteriorate gradually throughout the duration of the trial. It is interesting to note in passing that the rate of loss of vitality in the Italian seed was considerably less than was the case for the Perennial sample, but why this should be so is not clear.

When the previous small sample trials were in progress for some time a somewhat similar set of investigations was begun, using larger bulks of Ryegrass seeds which were stored under different conditions. A bale of Perennial Ryegrass seed was thoroughly mixed and divided into two equal lots of approximately one half cwt. each. When both portions had been sampled and tested for germination, one lot was stored in an unheated,

dry, airy corridor attached to the Seed Testing Station, while the other was placed in the storage premises of a Dublin seed merchant. A bale of Italian Ryegrass seed was similarly treated, and from time to time all four lots of seed were sampled and tested for germination. The results of this trial, which continued for five years, bear out the findings of the small scale experiment referred to above, and proved conclusively that the germination of these two varieties of seed was independent of seasonal changes. Under both sets of conditions deterioration of the seed took place, as may be seen from Tables V. and VI., but the rate of loss of vitality was much more pronounced where the seed was stored under warehouse conditions, and, as happened in the earlier trial, the Perennial seed deteriorated more rapidly than the Italian.

TABLES V. and VI. showing the annual percentage of germination of half cwt. lots of Perennial and Italian Ryegrass seeds stored under different conditions.

PERENNIAL RYEGRASS SEED (TABLE V.).

Storage.	Percentage of Germination.					
	Original Test.	After 1 Year.	After 2 Years.	After 3 Years.	After 4 Years.	After 5 Years.
Seed Testing Station	74	79	74	60	50	39
Warehouse ...	80	79	74	38	15	7

ITALIAN RYEGRASS SEED (TABLE VI.).

Storage.	Percentage of Germination.					
	Original Test.	After 1 Year.	After 2 Years.	After 3 Years.	After 4 Years.	After 5 Years.
Seed Testing Station	80	78	76	72	70	63
Warehouse ...	79	69	75	48	36	26

In conclusion, it may be necessary once again to issue a word of warning as to the possible limited application of the results which have been obtained and described in this note, in which the rate of loss of vitality has been set out for certain varieties of seed when these were stored under a particular set of conditions. That seeds react to the conditions of storage is a well-established fact, but since storage conditions cannot be standardised there must always be an element of doubt as to how the germination of "held over" seeds may be affected. If of high quality in the first instance, and if the conditions of storage are favourable, very little deterioration may result from holding over certain varieties of seeds for one or, in some cases, possibly two years, but this practice is one that cannot be generally advised. Where it is impossible to clear stocks by the end of the season, a carry-over may be compulsory, and, in such circumstances, the seed should be stored under cool, airy and dry conditions. It frequently happens, especially on the premises of retail seed merchants throughout the country, that the season's surplus seeds are stored under damp and unsuitable conditions, where they deteriorate rapidly during the winter, and are useless for "seed" by the following Spring. Under no circumstances should a merchant expose or offer for sale, for sowing purposes, seeds which have been carried over from a previous year's stock without having them tested for germination, and in this way satisfy himself that they are suitable for the purpose for which they are intended.

WORLD'S POULTRY CONGRESS, 1930.

World's Poultry Congresses under the auspices of the World's Poultry Science Association (until recently the International Association of Poultry Instructors and Investigators) have been held triennially since 1921. Saorstát Eireann is a Patron of this Association and is represented on its Council. The Association has at present 38 members in this country, a relatively high membership compared with the membership in other countries with a similar population.

The first Congress was held in Holland* in 1921, the second in Spain in 1924, the third in Canada in 1927, and the fourth in Great Britain in 1930.

The objects of these Congresses are to bring together those concerned with the development of the poultry industry and promote international friendship, to pool the best and most recent knowledge concerning the poultry industry in all parts of the world, to improve and develop poultry research, education and economics, to encourage the improvement of poultry stocks in all countries and to stimulate trade.

A special feature of these Congresses has been the Congress Exhibitions.

The organisation of the Congress and of the Congress Exhibition as a whole is undertaken by the Authorities of the country in which the Congress is held. In the case of the Fourth Congress, which was held at the Crystal Palace, London, from 22nd to 30th July, 1930, the Governments of Great Britain and Northern Ireland undertook this responsibility, and the actual work of organisation was carried out by the English Ministry of Agriculture and Fisheries in conjunction with the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland. The Government of Saorstát Eireann were invited, in common with the Governments of other countries, to organise a delegation to attend the Congress and a National Exhibit in the Congress Exhibition. The Government accepted this invitation and the work of organising Saorstát Eireann's representation at the Congress and the Congress Exhibition was entrusted to the Department of Agriculture. The Minister for Agriculture appointed a National Committee to advise the Department on these matters and to act as a connecting link with the Congress Authorities in London.

Dr. J. H. Hinchcliff, Agricultural Director of the Department, was appointed Chairman of the National Committee, and Mr. T. O'Connell, Senior Agricultural Inspector of the Department, its Vice-Chairman. Its membership comprised Mr. R. Barton, Glendalough House, Annamoe, County Wicklow; Mr. E. Bohane, Director of the Royal Dublin Society; Mr. Ado Carton, of the firm of Messrs. Carton Bros., Dublin; Professor J. P. Drew, M.Sc., Dean of the Agricultural Faculty of University College, Dublin; Mr. R. N. Tweedy, President of the Irish Poultry Keepers' Co-operative Society; Mr. J. W. Dulanty, C.B. Commissioner for Trade, and now High Commissioner for Saorstát Eireann in London, and the following officers

* An account of Ireland's representation at the 1921 Congress appeared in Vol. XXI No. 3 of this Journal.

of the Department:—Miss M. Hennerty, N.D.P., Chief Poultry Officer; Miss K. Nunan, Poultry Teacher, Munster Institute, Cork; Mr. W. F. Prendergast, A.R.C.Sc.I., Agricultural Inspector; Mr. H. W. Stevens, Marketing Inspector, and Mr. D. J. McGrath, B.A., Head of the Department's Intelligence and General Division, who acted as Secretary to the Committee.

The Department are particularly indebted to Mr. Barton who, in addition to his assistance as member of the National Committee, was good enough to invite the large party of Congress delegates who visited Saorstát Eireann at the conclusion of the Congress to see his extensive and up-to-date poultry farm at Annamoe. The Department are also greatly indebted to Mr. R. N. Tweedy, President of the Irish Poultry Keepers' Co-operative Society, for the assistance given by his Society in securing entries from its members for the Live-Stock Section of the Congress Exhibition.

The first meeting of the National Committee was held on 14th May, 1929, and steps were immediately taken through the medium of the Press and otherwise to bring the Congress to the notice of the poultry breeders and others concerned either as educationists and research workers or from the administrative or commercial side of the industry. As a result a large number of persons from Saorstát Eireann availed themselves of the opportunity which the Congress afforded of obtaining the most up-to-date information regarding the progress of the industry throughout the world and at the same time of bringing to the notice of those interested in the industry in other countries what had been achieved in Saorstát Eireann in the production of high class poultry and poultry products.

The official delegation to the Congress consisted of Dr. Hinchcliff, Mr. T. O'Connell, Miss Hennerty, Miss Nunan, Mr. Stevens, Professor Craig (Principal of the Veterinary College of Ireland), and Mr. D. J. McGrath. Among the Bodies who appointed representative delegates were the following:—University College, Dublin, the Irish Agricultural Organisation Society, the Irish Poultry Keepers' Co-operative Society, the Royal Dublin Society, the Irish Farmers' Union, and two of the Egg Merchants' Associations in Saorstát Eireann. In addition, the County Committees of Agriculture were represented. In almost all cases, these Committees, with the approval of the Department, granted their Instructors in Poultry-Keeping special leave of absence to attend the Congress and in addition defrayed their travelling expenses to and from London. These Instructors afforded much help to the National Committee in bringing the Congress to the notice of poultry-keepers in their respective districts, in inducing them to enter exhibits of live poultry, and subsequently in assisting them in the selection and preparation of birds for exhibition. The large and representative collection of high class " utility" poultry from Saorstát Eireann displayed in this section, which was the subject of much complimentary comment from visitors from other countries, testified to the value of the work done by the County Committees of Agriculture and their Poultry Instructors under the Department's Schemes for the improvement of poultry. A limited number of the Instructors were appointed to act as demonstrators at Saorstát Eireann's Stands at the Exhibition.

The following Papers were prepared and presented to the Congress by delegates from Saorstát Eireann and are printed in the official Proceedings of the Congress:—

Instruction in Poultry-Keeping in the Irish Free State, by Miss M. Hennerty, N.D.P., Chief Poultry Officer, Department of Agriculture.

Marketing of Irish Free State Poultry and Eggs, by H. W. Stevens, Marketing Inspector, Department of Agriculture.

The Optimum (Starch Equivalent) of the Meal Mixture for Chickens and Growing Pullets fed on All-Mash Diet, by E. J. Sheehy, F.R.C.Sc.I., B.Sc., Lecturer in Animal Nutrition, University College, Dublin.

Blackhead in Turkeys, by Professor J. F. Craig, M.A., M.R.C.V.S., Principal, Veterinary College of Ireland.

The Congress was formally opened by H.R.H. the Duke of York on 22nd July. Paper-reading Conferences, each dealing with a particular subject, commenced on 22nd July and were continued each morning in five conference halls during the period of the Congress. Delegates from Saorstát Eireann attended and participated in the discussion on several Papers in each section. Government and other hospitality on a munificent scale and numerous entertainments were arranged for members of the Congress. Sixty-one countries participated in the Congress and the membership totalled, approximately, 2,300 persons. Over 80,000 persons visited the Congress Exhibition.

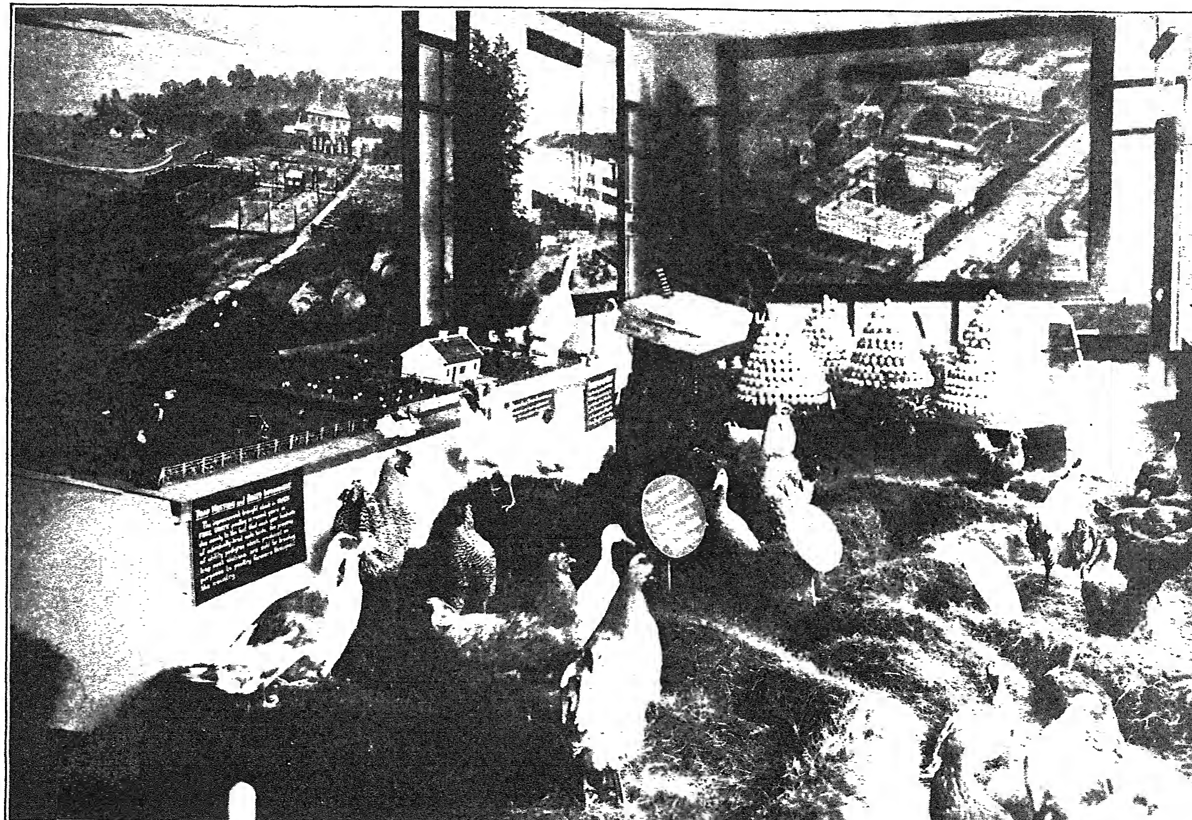
THE CONGRESS EXHIBITION.

The Congress Exhibition, which occupied the Crystal Palace, London, was divided into three main sections.

The "National Exhibits" Section was located in the north nave of the Crystal Palace, and, as its title indicates, was devoted to "National Exhibits," illustrating the part played in each of the participating countries by education, research and economics in the development of the poultry industry. In addition to poultry matters, National Committees were afforded opportunities in their "National Exhibits" of bringing the general national features of their respective countries to the notice of the public, but commercial advertising was strictly prohibited in this particular section of the Exhibition. Exhibits of twenty-five countries were shown in this section. In addition to having a "National Exhibit," Saorstát Eireann was given a separate exhibit (organised by the Office of the High Commissioner in London) in the Empire Marketing Board's Exhibit in this section. A short description of several of the National Exhibits of other countries is contained in the extract from the Exhibition catalogue printed as an appendix to this Article.

The "Commercial Section," which filled the south nave (and its galleries) of the Crystal Palace, was confined to commercial exhibits of interest to the poultry industry, but, excepting day-old chicks, the exhibiting of live poultry was not permitted in this section.

WORLD'S POULTRY CONGRESS EXHIBITION, 1930.

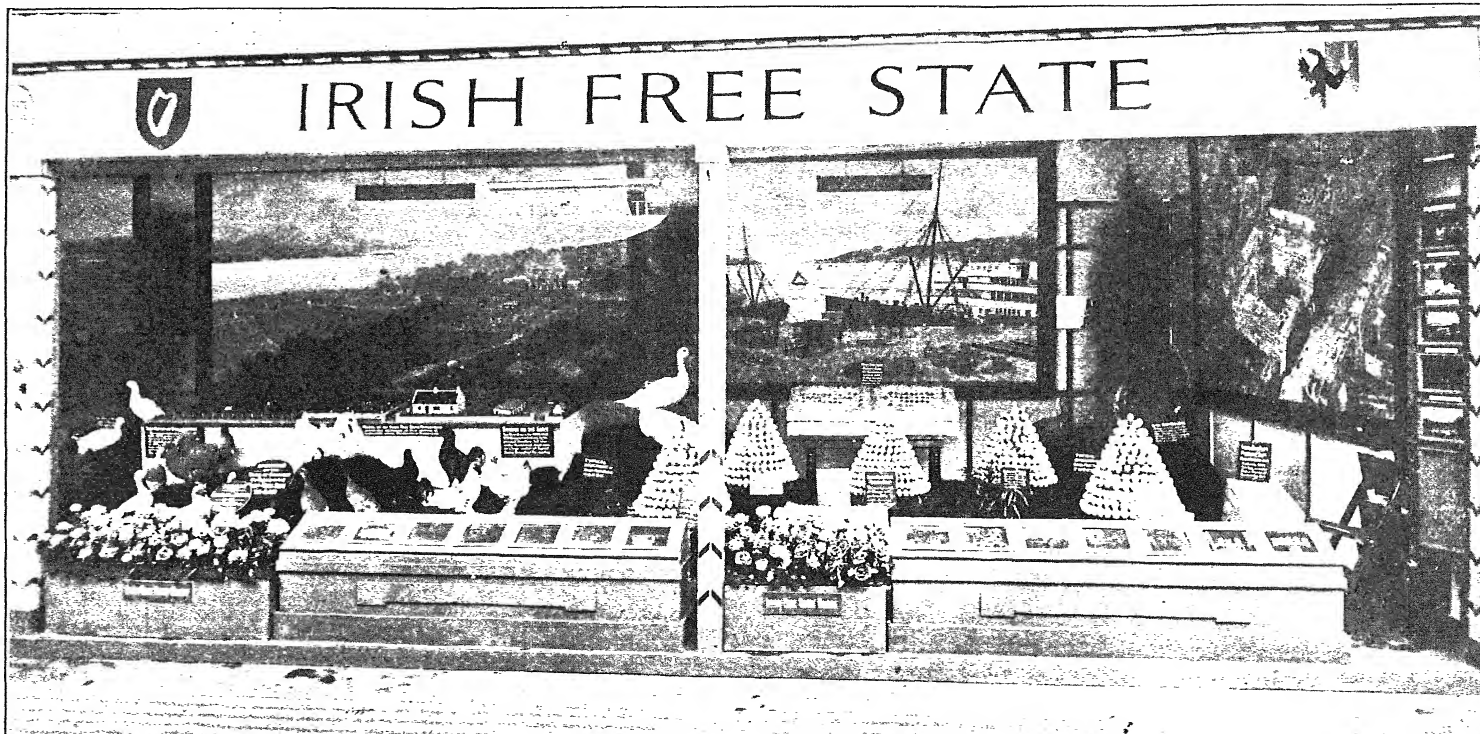


A CORNER OF SAORSTAT EIREANN NATIONAL EXHIBIT.

To face page 248

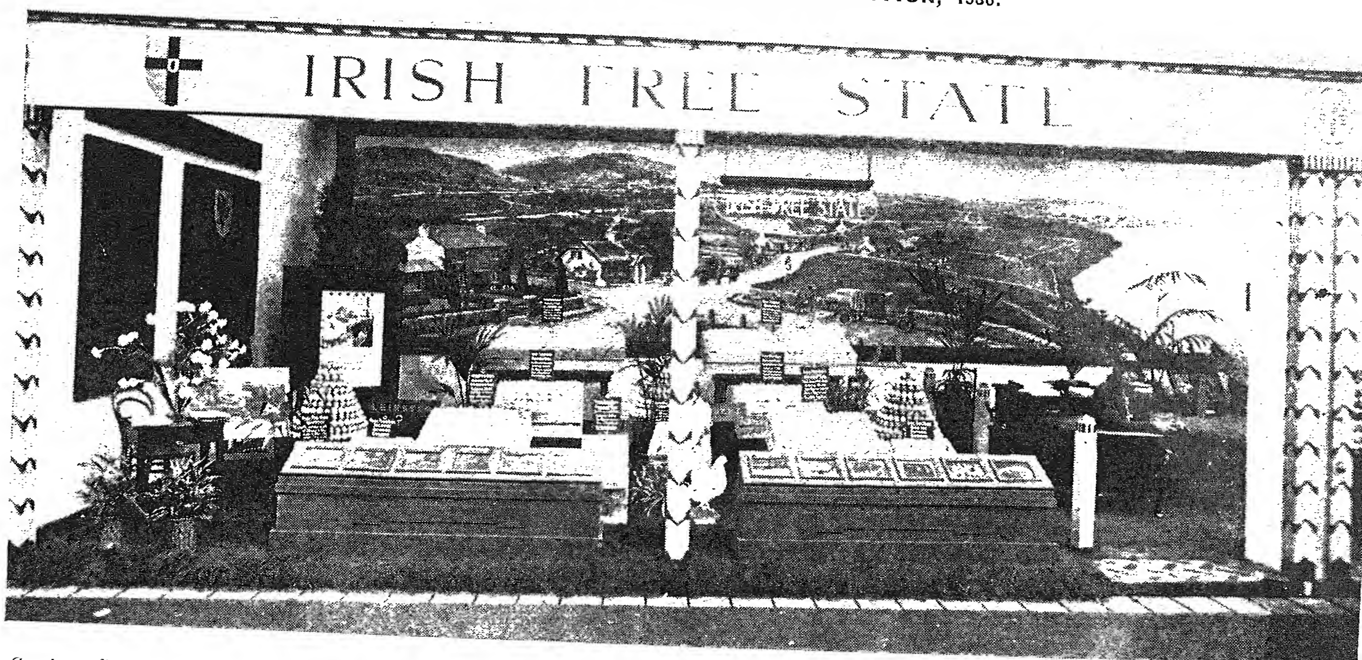
SAORSTAT EIREANN NATIONAL EXHIBIT: LEFT-HAND VIEW.

WORLD'S POULTRY CONGRESS EXHIBITION, 1930.



SAORSTAT EIREANN NATIONAL EXHIBIT : RIGHT-HAND VIEW.

WORLD'S POULTRY CONGRESS EXHIBITION, 1930.



Courtesy of] SAORSTAT EIREANN COMMERCIAL EXHIBIT: LEFT-HAND VIEW. [Free State Farmer

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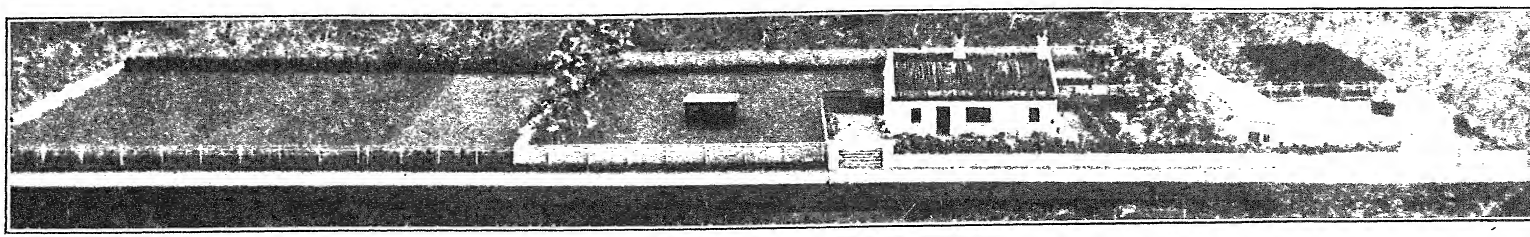

LARGE SCALE MODEL OF A TYPICAL TRAP NEST STATION FARM, INCLUDED IN SAORSTAT EIREANN COMMERCIAL EXHIBIT.

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The "Live-Stock Section," which occupied the ground floor and main terrace, with an annexe for rabbits and pigeons, consisted of live fowl (including ducks, guinea fowl and bantams), geese, turkeys, pigeons and rabbits. These exhibits were grouped on a National basis and the addresses of breeders were prominently displayed above their exhibits. Opportunities were also afforded for the distribution of breeders' catalogues. National Committees were asked to assist in securing that only exhibits of a high standard were entered from their respective countries. All live-stock exhibits not sold privately were put up for sale in accordance with the Congress Regulations, but exhibitors were allowed to place a reserve price on their exhibits.

No prizes or medals were awarded for exhibits in any section of the Exhibition.

SAORSTÁT EIREANN'S EXHIBITS.

Saorstát Eireann's National Exhibit.—This Exhibit, which occupied a central position in the north nave of the Crystal Palace and covered an area of eight hundred and sixty-four superficial feet with a frontage of forty-eight feet, was flanked on one side by the Canadian National exhibit and on the other by that of the Soviet Union. For the woodwork forming the front of the Stands in this section and the Trade Section of the Exhibition, a colour scheme of primrose yellow relieved by herringbone flecking and stencilled *motifs* of poultry, rabbits, etc., in black, was prescribed by the Congress Authorities. The fronts of the Stands were required to be of uniform height and design, bearing fascia boards, on which the titles of the Stands were inscribed in block lettering of uniform design.

The Stand containing Saorstát Eireann's Exhibit was rectangular in shape, open at the front, closed in at the ends and back and roofed over with a light fabric covering. The entire floor space was covered with a specially prepared green carpet effectively representing natural grass which formed a pleasing contrast to a decorative floral display of natural roses grown in Saorstát Eireann which were banked along the entire front of the Stand. The façade was ornamented with artistically designed shields, the work of a Dublin studio, showing in their proper heraldic colours the Arms of the Four Provinces, and with a series of artificially illuminated transparencies manufactured by a Dublin firm from photographs taken specially for the Exhibition, demonstrating various phases of general agricultural education and development in Saorstát Eireann.

The Exhibit comprised two main divisions, one designed to focus attention on the various educational measures in operation in Saorstát Eireann with the object of improving the poultry industry in all its phases and the other organised to illustrate the up-to-date methods adopted in the preparation and marketing of poultry and poultry products for export.

On the back wall of the Stand were displayed three large pictures in colour, suitably framed, which were painted in Dublin for the Exhibition; one of these portrayed the Munster Institute, Cork, with the National Egg-laying Competition runs in the foreground; another a typical countryside scene in Saorstát Eireann; and the third a scene descriptive of the shipment of eggs from one of the ports. These paintings were included in the Exhibit

(*a*) to draw attention to the facilities for education and research in connection with poultry-keeping provided in Saorstát Eireann (*b*) to illustrate the healthy free-range methods of poultry-rearing generally practised in the country; (*c*) to emphasise the facilities provided for the rapid transport of poultry, poultry products and other perishable produce exported; and (*d*) to attract attention to the scenic beauty of the country. That these paintings served the latter purpose was evidenced by the fact that numerous visitors to the Exhibit were favourably impressed by the beauty of the scenery depicted, and several inquiries regarding the facilities for holidaying in Saorstát Eirann were dealt with by the demonstrators at the Stand.

On one of the end walls of the Stand were displayed two large scale-maps on which were shown, by means of coloured lights, the exact location of each egg distribution station operating under the provisions of the Department's Poultry Schemes administered by the County Committees of Agriculture. The other end wall was decorated with a large sized picture of Government Buildings, Dublin, and adjoining parts of the City.

Attention was drawn to the importance of egg-laying competitions as a factor influencing poultry development by a series of models of the runs and houses employed in the National Egg-laying Competitions at the Munster Institute, Cork, and by a collection of mounted specimens typical of the White Wyandotte breed, the breed which has consistently given the highest egg yields in these competitions. The benefits, by way of improvement, in the general quality of poultry stocks in Saorstát Eireann, which have accrued from the various development schemes and educational measures introduced and carried out by the Department and the County Committees of Agriculture were demonstrated by contiguous exhibits, one showing mounted typical specimens of the breeds of poultry now widely kept in Saorstát Eireann, and the other showing similar specimens of the mongrel type of stock which were to be found on most farms in the country some years ago. Particular attention was drawn to the trap-nesting scheme now in operation in Saorstát Eireann, and in this connection a large-scale model of a typical trap-nest station farm in Saorstát Eireann was included in the Exhibit.

In a subsidiary marketing division of the Exhibit packages of fatted poultry and ducklings, cases of eggs of the various grades exported, and demonstrations of the methods adopted in the testing, grading, and packing of eggs for export were displayed.

Attention was drawn to the educational facilities provided in connection with poultry and general agricultural development in Saorstát Eireann by means of an elaborate series of diagrams and photographic illustrations, some stationary, others shown in sequence by mechanical devices which automatically illuminated and displayed each diagram or picture in turn.

A fifty-page Brochure, with a cover representing in bright colours an emblem of the poultry industry, and profusely illustrated from photographs taken specially for the purpose, descriptive of Saorstát Eireann generally and the poultry industry in particular, was prepared for the Exhibition and copies were distributed gratis to interested visitors.

The Stand was brilliantly illuminated by a series of concealed electric lights.

Saorstát Eireann's Commercial Exhibits.—The Exhibit staged by the National Committee in the Commercial Section of the Exhibition consisted of a large and imposing Stand advertising the eggs and dead poultry exported from this country. This Exhibit was organised and displayed by the National Committee on behalf of 182 firms in Saorstát Eireann engaged in the export of one or other of these commodities. A sum of over £600 was contributed by the firms on whose behalf the Exhibit was organised, and the balance of the cost was defrayed from State funds.

The Stand occupied a space of 720 superficial feet with a frontage of 48 feet. As in the case of Saorstát Eireann's Stand in the National Exhibit Section, the Stand in the Commercial Section conformed to the approved design adopted throughout the Exhibition and was rectangular in shape, open at the front, closed in on the back and ends, and roofed over with a light fabric covering. A space in the centre of the Stand was reserved for the purpose of interviewing visitors and was suitably furnished for this purpose. On both flanks of this space representative exhibits of the various classes of eggs and dead poultry exported from Saorstát Eireann were staged. The names and addresses of the firms who contributed to the cost of the Exhibit were inscribed in large letters on decorative panels which covered the side walls of the Stand. A list of these names and addresses were also included in a Brochure advertising the eggs and poultry products of Saorstát Eireann, copies of which were distributed to visitors. The Brochure was specially prepared for the Exhibition by the National Committee. It bore an attractive coloured cover and contained numerous photographs taken specially for the purpose of drawing attention to the excellent qualities of the country's poultry products and the careful manner in which they are prepared for market.

Situated as it was in one of the main aisles of the Exhibition, the Stand was an acknowledged centre of interest to visitors.

A striking feature of the Stand was a specially prepared large coloured picture of rural Ireland. This picture, which extended along the back of the Stand, was specially painted in Dublin for the Exhibition. It depicted pastoral life with flocks and herds amid charming scenery, villagers bringing baskets of eggs to the collecting lorries of the egg shippers, the speedy transfer of the eggs to the ports, and steamers taking them across the short sea passage to Great Britain, where the eggs were portrayed on sale in the shops there. This picture served admirably the purpose of bringing home to the onlooker the healthy conditions under which poultry exist in Saorstát Eireann, the close proximity of the producer to the British markets and the fresh condition in which eggs from this country reach the British market. Its decorative value added also much to the general attractiveness of the Stand.

The exhibits on the Stand included a complete series of the various classes of eggs exported from Saorstát Eireann, graded and packed in accordance with the Regulations of the Agricultural Produce (Eggs) Act, 1924.

Exports of eggs from Saorstát Eireann to-day are far different from those exported even in the recent past. The eggs are now offered in grades and the grades are so adjusted that they meet the varying requirements of the retail trade. Eggs of brown colour now form a predominant portion of the exports, as this colour is preferred to white by consumers, and eggs from Saorstát Eireann have gained a reputation for a full and rich flavour.

In displaying the eggs on the Stand use was made of special devices, *e.g.*, wire pyramids specially manufactured by a Dublin firm were used to show the various grades of eggs. In addition, specimens of each type of standard commercial package prescribed under the Agricultural Produce (Eggs) Act for the transport of eggs were shown, each packed with eggs graded in accordance with the requirements of the Act, the top layer being exposed to full view.

Dressed poultry graded and packed according to the weight of the bird and suitably tied for display on the poulterers' counters were also displayed on the Stand. In order that the poultry displayed might be in the freshest and finest condition, consignments were obtained daily from Saorstát Eireann.

Several novel features were included which gave the Stand an animated appearance. For example, rotating illuminated coloured pictures and "slogans" advertising the good qualities of Saorstát Eireann eggs and poultry drew the attention of the visitors; attractive life-like pictures of typical specimens of various breeds of poultry kept in Saorstát Eireann mounted on ply-wood cut out to the exact shape of the birds were shown interspersed with the exhibits of poultry products, and along the front of the Stand were placed illuminated transparencies made by a Dublin firm from photographs, taken for the Exhibition, of pupils at the classes in egg and poultry marketing organised by the Department. The Stand was suitably decorated with a quantity of natural flowers, and was brilliantly lighted by concealed electric lights.

The Stand, in addition to showing the good qualities of eggs and poultry exported from Saorstát Eireann, was specially designed to emphasise the fact that these products reach the British markets in as fresh a condition as if they were produced in Great Britain itself, a fact which it is particularly necessary to stress since the introduction of the Order of the British Government which requires that all imported eggs shall be marked so as to indicate that they are imported produce. As a further means of bringing home to the producer the fresh condition in which poultry products from Saorstát Eireann are landed on the British markets, a suitably worded advertisement was inserted by the National Committee in the catalogue of the Congress Exhibition.

Saorstát Eireann's Live Stock Exhibits.—Exhibits in the Live-Stock Section were subdivided into two main classes:—(a) Egg recorded stock (single bird entries); (b) Utility Pedigree stock (trios). Practically all exhibiting countries, including Saorstát Eireann, entered birds in both groups.

Saorstát Eireann's Exhibit of live-stock, which was accommodated in a most central position in the main Gallery, comprised 44 entries in Class (a) divided up among the principal breeds of fowl as follows:—

White Wyandotte	23
White Leghorn	10
Rhode Island Red	6
Light Sussex	4
Barred Plymouth Rock	1

In Class (c) there were 86 trios of utility pedigree stock consisting of:—

White Wyandotte	34
White Leghorn	17
Rhode Island Red	16
Plymouth Rock	6
Light Sussex	6
Barnevelder	3
Welsumer	2
Jersey Black Giant	1
Australorp	1

In addition 7 American Bronze Turkeys from Saorstát Eireann were shown.

In both classes the quality of the birds entered by exhibitors from Saorstát Eireann was of a high standard, and the Exhibits as a whole won the praise of many keen judges of poultry from other countries which were represented at the Congress. A characteristic of the birds from Saorstát Eireann in the Egg Recorded Section which attracted universal attention was the combination of correct type with high egg yield and low percentage of second grade eggs.

The exhibits of turkeys, typical of the class of breeding stock kept in Saorstát Eireann, though few in numbers, were of outstanding quality.

Practically every district in Saorstát Eireann was represented by one or more exhibits, and the bulk of the birds in the Egg Recorded Section were drawn from the ordinary stock kept on the trap-nest and egg-distribution stations established throughout the country under the Department's schemes for poultry improvement.

The most striking evidence of the superior quality of the exhibits of live poultry from Saorstát Eireann was the fact that during the early days of the Congress many of the exhibits were sought for by several prospective purchasers although only a small proportion of the exhibitors desired to sell their birds and, accordingly, had fixed very high reserves for them. In consequence, several of the exhibits were sold subsequently at the auction at a considerably higher figure than the reserve. Included among the purchasers were many well-known breeders from overseas countries.

POST CONGRESS TOUR.

The Organising Body of the Congress arranged a short official tour of Great Britain and Ireland, commencing on 31st July, 1930, at London, and concluding there on 11th August, 1930. The main object was to combine a visit to places of interest to agriculturists in general and poultry farmers in particular, with a run through the beauty spots and historic centres of England, Scotland, Wales and Ireland. A brief visit to Saorstát Eireann was linked up with this official tour. The period made available for this visit was limited to two days, one of which was Sunday. The National Committee undertook the duty of arranging for the reception of the visitors in Saorstát Eireann. During the short period available it was found possible to arrange for a visit of the delegates to the Munster Institute, Cork, where they were entertained to luncheon by the Minister for Agriculture, and for a visit to Mr. Robert Barton's poultry farm at Annamoe, Co. Wicklow, where Mr. Barton received the delegates and showed them the excellent modern arrangements carried out there for the production of table poultry and eggs on an extensive scale. A charabanc tour through some of the beautiful scenery of County Wicklow concluded the itinerary. A visit to Killarney was provided as an alternative to such of the party as preferred to see the Lakes of Killarney instead of visiting the Munster Institute. The number of delegates taking part in the tour exceeded 300, and they expressed themselves as highly gratified with the arrangements made for their reception in Saorstát Eireann. It is regretted that the shortness of the visit made it impossible to give them a closer acquaintance with the poultry industry as carried on in Saorstát Eireann.

CONCLUSION.

There is no doubt that the 1930 Congress succeeded admirably in serving the purposes for which these Congresses have been initiated. The representatives of 61 countries were brought together in friendly co-operation for the advancement of the poultry industry throughout the world. The Papers read by, and the discussions, whether formal or informal, between, the representatives of so many countries were of very great usefulness in promoting a wider knowledge of many matters of practical importance to the industry. A great deal of practical information was gained from the National and other Exhibits of the participating countries, whose National Committees appear to have spared no trouble to ensure that their exhibits would be not only of great spectacular interest but would also convey in an instructive manner the developments and improvements effected by research, education and administrative measures in their respective countries.

It is pleasant to be able to record that in these respects Saorstát Eireann Exhibits won special commendation and justified the large amount of organising work involved in their preparation and staging. Although the Exhibition was held in London, all work, as far as possible, in connection with the preparation of Saorstát Eireann's Exhibits was carried out in Saorstát Eireann, including the construction of models, the preparation

of mounted specimens of the various breeds of poultry, the painting of the large pictures used as backgrounds to the National and Commercial Exhibits, and all printing and sign-writing. The Irish Tourist Association rendered very valuable assistance to the National Committee in placing at their disposal the services of the Association's photographer, who was responsible for most of the numerous photographs reproduced in the transparencies shown on the Stands and in the Brochures prepared for the Exhibition.

In all the onerous work connected with the preparation of this country's Exhibits, the National Committee and the Department are indebted to the helpful and willing co-operation extended to them at all times by Mr. P. A. Francis, the Director of the Congress, by Dr. V. E. Wilkins, the Congress Secretary, and by other Officers of the English Ministry of Agriculture and Fisheries.

APPENDIX.

Description of National Exhibits of various countries reprinted from the Official Catalogue of the World's Poultry Congress Exhibition, 1930.

Belgium.

The main feature of the Belgian National Exhibit consitsts of two tableaux depicting the poultry and rabbit breeding industries. These are accompanied by a series of striking photographic illustrations showing :—(i.) The laying hen (selection and breeding; incubator and brooder; poultry on the general farm and the commercial poultry farm); (ii.) The table fowl (Cocou de Malines: eggs, incubator and chickens; outdoor and indoor breeding; fattening, killing and preparation for table); (iii.) The rabbit (Belgian breeds; centre for sale of rabbit skins and flesh) Statistics relating to the egg trade are given.

Other sections of the Exhibit deal with (*a*) raw materials—production and markets (*b*) export trade; (*c*) extent of imports and exports; and (*d*) the rabbit skin in the fur industry.

Canada.

The keynote of the Canadian educational exhibit is the economic worth of Canadian poultry breeding stock. The setting and background is a panorama of a prosprrous industrial Canada. The exhibit contains pens of high-class representative and high-power Canadian breeding stock and illustrates the method by which this vigorous stock is carried back from the plants of the breeders through the approved flocks to the approved hatcheries from which are distributed millions of baby chicks to the farms of Canada.

These pens of birds are brought to view in a succession of animated pictures portraying an ascending scale of quality, which culminates in the high-power registered pedigree Canadian breeding stock.

The general view of the panorama of Canada presents characteristics such as elevations, forest and plain areas, lakes and rivers and agricultural lands. Superimposed on the general panorama are symbolic devices which are used to indicate important centres, various industries and natural resources.

An effect of day and night is obtained by the use of a series of different coloured lights. The whole arrangement of lighting is designed to show to best advantage the constantly changing scenes which follow each other in regular sequence.

Denamrk.

The Danish National Exhibit includes (i.) coloured charts and statistics illustrating the development of the poultry industry in Denamrk; (ii.) a collection of coloured lantern slides showing typical Danish poultry farms, breeding centres and egg packing stations; (iii.) a model of one of the compartment poultry houses used in the Official "Egg-Laying Competition"; (iv.) models of poultry houses of a type preferred by Danish poultry keepers; and (v.) baskets containing eggs of the principal breeds, and Danish eggs packed for export.

In addition, various appliances, pictures and photographs are displayed, together with Danish poultry literature: books, periodicals and reports on the experimental and educational work carried out in Denmark, and a pamphlet (in English) on poultry breeding and egg production in that country.

France.

The French exhibit is designed to set out the story of national progress. All the typical French breeds that enjoy a reputation beyond their country's boundaries are shown through the medium of large photographs—the capons and pullets of Le Mans and La Bresse, the turkeys of Sologne and characteristic examples of such breeds as the Houdan, Faverolle, and the Gatinaise. The results obtained by different breeds at the National Egg Laying Competition are set out in graphs and tables; and particulars are given of the rate at which certain favourites, *e.g.*, the White and Black Bresse, the Gatinaise, and the Geline of Touraine, put on weight while improving in egg production.

The exhibit includes a typical display of the furs and skins of rabbits. Toilet requisites made from the down feathers of the goose offer a special appeal to the ladies, and examples of pate de foie gras from Perigord may be relied upon to appeal to both sexes of all nationalities. Some of the rabbit fur is of breeds little known in this country—the White Bouscat and the Castorrex, for example. At the same time, the French Committee is exhibiting some remarkable photographs showing the development of national breeds of horses, cattle and sheep.

Germany.

The German Educational Exhibit provides a survey of all questions of outstanding interest to German poultry breeders and keepers.

Five special sections illustrate the economic importance of poultry-keeping and egg marketing; questions of feeding and rearing; everything connected with breeding and rearing; measures taken to instruct the modern poultry breeder and keeper; as well as the steps taken to control poultry diseases. The leading scientific, educational and research institutions of Germany have collaborated in supplying the exhibit material, whilst the German National Committee has devoted itself to the task of providing popular economic illustrations.

Netherlands.

Utility poultry-keeping is carried on in Holland both as a main industry and as a side line in agriculture, and the great importance of poultry-keeping so far as the public is concerned lies principally in the latter. In the case of the small farmer on sandy lands, poultry-keeping as a side line has an importance not to be under-estimated. The State is seeking by means of instruction and advice to teach the farmer how to run this branch of his industry as economically as possible. In their National Exhibit the Dutch Committee represent this work by means of statistics, pictures, photographs, etc.

Scientific work carried on at State institutions and by private persons is shown, and the results of various tests are given.

In Holland there are two utility breeds—both of Dutch origin—which lay eggs with a dark brown shell. The exhibit shows how these breeds evolved and contains examples of their brown-shelled eggs.

Finally, an account is given of the efforts that are being made to improve the quality of eggs, and a sketch of the method by which sales are controlled.

New Zealand.

The display by the New Zealand High Commissioner is arranged to give some indication of the development of the poultry industry in New Zealand, and at the same time to portray the great possibilities of future expansion.

New Zealand is at present developing what might be called her "small" industries, such as fruit-growing, honey production, and the poultry industry.

In addition to the poultry exhibit the stand contains other export products of the Dominion, such as butter and cheese, honey, apples, etc.

Norway.

The Norwegian Exhibit comprises:—

(1) Outline maps of Norway showing (*a*) the organisation of poultry associations, farmers' and small holders' unions; (*b*) turnover and production: and locating egg-collecting stations and egg-export associations; and (*c*) breeding-centres, control breeding stations and control poultry-farms.

(2) Graphic Charts representing (*a*) the increase in poultry-production in relation to population and area of cultivated land; (*b*) the average production at control breeding stations; (*c*) the production per hen during three successive years at control breeding stations.

The Exhibit also includes eggs packed in standard containers. Illustrated maps showing the production and consumption of eggs over a period of 40 years are shown, together with photographs of some of the largest poultry farms, poultry schools and egg stations in Norway.

An illustrated booklet on poultry-keeping and the production of eggs in Norway is available, together with other pamphlets and a textbook.

Sweden.

Sweden's National Exhibit demonstrates various aspect of the Swedish poultry industry and egg export trade, and the extensive educational and research work carried out in the country. Features of special interest are a demonstration of the part played by electricity in poultry breeding, egg production, transport, etc., and a series of photographs and tables illustrating the work of Dr. H. Magnusson of Malmo, on the diseases of poultry. The exhibit also includes charts showing Sweden's egg exports, poultry population, etc., and photographs of some prominent and representative Swedish breeds of poultry.

United Kingdom of Great Britain and Northern Ireland.

The exhibit is in two parts; one devoted mainly to education and research work in poultry husbandry and the other to marketing. The *education and research* section is located in the Centre Transept in association with the Empire Marketing Board's display of Empire poultry and other products. The Central feature is the "Golden Gate" that leads to success and is symbolical of the important part which the teacher, adviser and research worker are playing in the development of the poultry industry. The position and progress of the industry is shown in a series of bays devoted to graphic portrayals of statistical data.

The education section of the Exhibit illustrates important features of the teaching advisory work carried out by county poultry instructors, agricultural colleges, county farm institutes and other centres in the United Kingdom. The rabbit industry is represented, *inter alia*, by an exhibit of Angora garments (accompanied by demonstrations of the spinning of Angora wool) and the Fur Board's display of rabbit fur garments. Messrs. Harrods, Ltd., have kindly dressed the window for the Fur Board exhibit and have pron vided the mannequins.

As indicated on one of the signposts pointing the way through the "Golden Gate" to success, research workers at many centres are engaged in solving the poultry industry's vital problems of breeding, nutrition, management, disease, economics and marketing. Aspects of this work are demonstrated in the research section.

A pamphlet describing the Education and Research Section of the Exhibit in more detail may be obtained from the Bureau at the Exhibit Stand.

The *marketing section* of the Exhibit is situated at the end of the North Nave, and is briefly described in the following notes:—

England and Wales.—At National Stand No. 132 a working demonstration will be given of the preparation of eggs for market at a National Mark egg-packing station. Separate sections of the exhibit will show (*a*) why eggs should be paid for on grading-out results; (*b*) single candling; (*c*) weight grading to national standards on a Frost mechanical grader; and (*d*) packing in non-returnable wooden and fiberite cases and in cartons holding 6 or 12 eggs.

At National Stand No. 133 there will be a working demonstration of the operations of a National Mark poultry fattening station, including weighing on arrival and payment by weight and according to quality; fattening in batteries and the final period of cramming; killing, plucking, dressing, cooling, and shaping; and grading and packing in non-returnable boxes.

Publications relating to the application of the National Mark to eggs and pountry are available at the Stands.

Scotland.—At National Stand No. 134, Scotland has her own National Mark egg exhibit, which comprises the following items:—A weighing machine designed to carry a tray containing 10 dozen eggs and suitable for use by registered packers grading in accordance with National Mark requirements; three small weighing machines on each of which is shown the minimum weight for any 12 eggs of each of the grades—specials standards and mediums; full cases of each grade of egg; and empty cases showing the manner of affixing the National Mark labels.

Leaflets entitled "Grade Designations and a National Mark for Hen Eggs produced in Scotland," and "Rules to be observed by Registered Packers" (Ag. 152), may be obtained at the stand, together with publications dealing with Scottish schemes for the improvement of poultry.

Northern Ireland.—At National Stand No. 131, Northern Ireland has staged a separate egg marketing demonstration. The exhibit illustrates the essential points of the marketing system of the Province, and its administration, and demonstrates the methods by which the eggs are controlled from the producer to the consumer. A descriptive pamphlet may be had on application at the Stand.

United States of America.

The United States exhibit is divided into two parts one telling the story of poultry and egg production and the other illustrating some of the marketing phases of this work.

The production phases consist of exhibits on breeding, incubation and brooding and sanitation. In the breeding section the influence of persistency, intensity, broodiness, and early maturity on the inheritance of egg production is shown by the use of three mounted hens of low, medium and high egg production. Moving eggs, an egg motor and a glass trap nest are used to show the relation of those characters to egg production.

The history and evolution of incubation and brooding is portrayed by the use of automatic lantern slides. The nutrition exhibit consists of a large mechanical hen in which moving parts show the digestive processes as well as the role played by the various nutrients in the formation of eggs. This hen tells her own story on a talking phonograph record.

The marketing exhibit shows the enormous production of eggs by the use of a large clock, which bears the message that every time the pendulum swings 1,000 eggs are produced in the United States. This group also pictures the scope of the poultry and egg industry, showing how the products are utilised and the variation in prices, and production of poultry and eggs which occur at different seasons.

Another feature of the egg marketing exhibit is a candling demonstration to show the quality and grade of eggs. Eggs of various types are shown under refrigeration and standard types of egg crates and packing material are displayed. A feature of the marketing poultry exhibit is the display of dressed poultry attractively packed, including canned poultry products. A large illustrated map shows the poultry and egg producing sections of this country, while scenes and legends projected automatically on a screen are used to show the entire process of marketing eggs and poultry from farm to consumer.

POTATO GROWING FOR SEED PURPOSES.

By W. D. Davidson, B.A., B.Sc.

The growing of seed potatoes for sale is a new industry in this country. A trade in ware potatoes has been long in existence, but until recent years the cultivation of potatoes for the production of high class seed, or for the double purpose of producing seed as well as ware, received little attention. For many years large quantities of seed potatoes were imported annually from Great Britain. That position of affairs has been completely altered, inasmuch as while imports of seed potatoes from Great Britain have practically ceased, an export trade in high grade seed is being steadily built up.

The factors essential to the successful development of a seed potato trade may be summarised as follows:—(1) The Seed must be true to name; (2) the Seed must be pure; (3) the Seed must be properly graded; (4) varieties must be grown which are in demand on the markets to be catered for; and (5) what is of much importance, stocks must be vigorous and free from diseases carried by tubers such as Leaf Roll, Mosaic and Black Leg.

1. **Trueness to Name.**—It was formerly a common practice to apply new names to old varieties and to sell those so-called new varieties at greatly enhanced prices. The Up-to-Date, for example, had almost two hundred different names, while British Queen and Abundance had each nearly one hundred synonyms. As a result of the work carried on since 1915 at Ormskirk and from a later date at Edinburgh, the characteristics of the different commercial varieties are now so well known and recorded that buyers by taking ordinary precautions can easily avoid being imposed on by sellers who offer them old varieties under new names at fancy prices.

Within the past eight years samples of nearly all the varieties of potatoes grown in Ireland have been collected and their special characteristics noted in detail. The results, which are set forth in this article, should prove of very considerable assistance to any grower who may wish to satisfy himself that his crops are true to name.

2. **Purity of Seed.**—Buyers have frequently complained, and not without cause, of the difficulty of procuring Irish-grown seed which is pure as well as true to name. That substantial improvement is being effected in this direction is shown by the fact that the acreage of potatoes certified by the Department as suitable for Seed Purposes has increased from 200 acres in 1922 to 2,916 acres in 1930.

The exercise of the greatest care is needed by growers to ensure that their stocks are kept pure. When seed is stored in boxes and properly sprouted, impurities can usually be readily recognised by their sprouts and should be

removed. If this precaution has not been taken, and mixed seed has been planted, impurities must be dug out clean during the growing period. The pulling of "tops," leaving the tubers in the ground, is an extremely bad practice. Crops have to be rejected under the Inspection Scheme because rogueing has thus been improperly carried out.

In the case of crops offered for certification the Department insist, where two varieties are grown in the same field, that there must be a space at least nine feet wide planted with some other crop between the two varieties. The number of varieties that can be grown on the same farm is restricted to four, and in the case of these four no two varieties closely resembling each other in foliage and tuber can be grown.

Other causes of mixing are:—Too frequent cropping of the same field with potatoes, with the result that "ground keepers" become prevalent; planting headlands with a variety different from the main crop planted in the same field; the introduction with the farmyard manure of tubers which had been thrown into the manure heap; and, particularly in districts where potatoes are extensively grown, the carrying by crows and other birds of "sets" from one part of a field to another part or from one field to another.

3. **Grading.**—Growers may make or mar their reputation as seed producers by the manner in which they grade and turn out orders placed with them. It cannot be too strongly impressed upon all connected with the industry that when an order is accepted for a particular standard of grading, the potatoes supplied should be graded exactly to that standard.

The usual standard of grading required for the English market is $1\frac{1}{4}$-2 in., and for the Irish market $1\frac{1}{2}$-$2\frac{1}{4}$ in. In the case of some round varieties a $\frac{1}{4}$ in. more is allowed in the larger riddle. Except in the case of very delicate varieties, such as May Queen, Ninetyfold, Early Rose, and Beauty of Hebron—all very early varieties—seed should always be graded by means of hand riddles or with a machine made for the purpose. Experience has shown that the larger riddles to be effective must have all cross-wires welded. Otherwise the wires become loose after a short time, and allow tubers much above the specified size to pass through.

4. **Production of Varieties for which there is Demand.**—The varieties most in demand for seed purposes at present (1931) are:—

In Ireland:—

Earlies.—Epicure, and to a much less degree, May Queen, Duke of York, Sharpe's Express.

Second Earlies.—British Queen.

Maincrop.—Kerr's Pink, Champion, Arran Banner.

In England:—

Earlies.—Ninetyfold, May Queen, Eclipse, Sharpe's Express, Duke of York, Epicure.

Second Earlies.—Great Scot.

Maincrop.—King Edward, Majestic, Arran Banner.

There has also been a demand recently, but on a much smaller scale, for:—

Earlies.—Di Vernon, Early Rose, Beauty of Hebron, Arran Crest.

Second Earlies.—Catriona.

Maincrop.—Kerr's Pink, Up-to-Date.

For the export trade to the Canary Islands and certain other places abroad, the variety mainly in demand is Up-to-Date.

The most promising new variety put on the market in 1930-31 was Arran Pilot, an immune first early kidney, but it is too soon yet to express a definite opinion regarding its merits.

5. **Healthiness of Stocks.**—It is essential that stocks should be vigorous and free from hereditary diseases such as leaf roll, mosaic, black leg, etc.

Leaf Roll.—This is a hereditary disease, and all the tubers of an affected plant will produce diseased plants in the following year. The disease also spreads from one plant to another during the growing period. Plants so affected cannot under any circumstances produce a yield of more than half that given by a healthy plant. It is, therefore, a disastrous policy to retain for seed purposes the produce of a crop badly affected with Leaf Roll. Under the Department's Inspection Scheme the presence of *one plant* affected with Leaf Roll in a field of potatoes demands the rejection of all the potatoes grown in that field. Leaf Roll can be easily recognised, as the affected plants have a stunted appearance, the margins of the *lower* leaves roll inwards, the tips of the leaflets turn brown, and the leaflets on the lower leaves become thickened and brittle, and make a peculiar rattle when moved. Rolling of the top leaves on a potato plant is not, however, an indication of the presence of Leaf Roll.

Mosaic Disease.—This is also a hereditary disease. It is now well known that what was formerly called Mosaic Disease includes a number of diseases such as Mild Mosaic, Interveinal Mosaic, Streak, Crinkle, etc. It is possible that even some of the latter, such as Crinkle, may be caused by more than one distinct virus. These virus diseases have diverse effects on the different varieties and it is often difficult, if not impossible, to decide even upon the closest observation whether a potato plant is free from all these various forms of Mosaic. On the other hand, it is frequently quite obvious that a plant is not free from Mosaic. In certain cases the symptoms of this disease manifest themselves early in the season, while in other cases they appear only at a later period. Furthermore on certain days, usually in moist and cloudy weather, a plant may clearly show the characteristic mottle caused by some of the Mosaic diseases, while on other days, usually hot and sunny days, the mottle is completely masked.

Apart from the mottle on the leaflets which is associated with some of

the Mosaic diseases, one or more of the following symptoms is usually present in an infected plant:—

(*a*) reduction in the size of leaflet,

(*b*) waviness of the margin of leaflet,

(*c*) deformity in shape of some leaflets,

(*d*) wrinkling or puckering of leaflets,

(*e*) weakened stems resulting in a more sprawling habit of growth.

(*f*) earlier ripening of the plant,

(*g*) dwarfing of the whole plant may or may not occur,

(*h*) reduction in the amount of bloom produced, or

(*i*) increased susceptibility to blight.

On the other hand in the case of a healthy plant the leaflets are flat and uniform in colour. A form of Mosaic known as Aucuba Mosaic is so named from the resemblance which the bright yellow spots which appear on infected plants bear to those of the common shrub Aucuba japonica variegata. Apart from the occurrence of these bright yellow spots on the leaves, the disease appears to cause little damage. It is seldom found except on certain early varieties, *e.g.*, Ninetyfold, Fiftyfold and Early Regent, and is not of serious consequence.

Black Leg is a rather troublesome disease, which may or may not be carried in the tubers used for seed. Cutting of the "sets" undoubtedly increases greatly the number of plants affected with Black Leg. This is particularly noticeable in the case of Arran Consul. The disease makes its appearance early in the season, and continues to appear almost throughout the whole period of growth. A plant here and there may be noticed wilting and turning yellow. When pulled the stems will be found black and rotten at the ground level. The tubers are usually not more than seed size, and unless they rot in the ground or during storage they are likely to be planted the following season, thus perpetuating the disease.

Up to the present no method has been discovered by which the presence of any of the diseases already mentioned can be detected by examination of the tuber alone; in practice, therefore, the presence or absence of such diseases can be determined only during the growing stages.

Steps to Combat Virus Diseases.—The question may be asked, what practical steps can a grower take to combat these diseases? The subjoined measures are recommended:—

(*a*) A grower who finds his crop badly affected should dispose of the entire produce and purchase fresh seed.

(*b*) In the case of a less seriously affected crop much can be done to secure a healthy stock by procuring a small quantity of seed from strong, vigorous, healthy plants specially selected in a part of the field where there are fewest diseased plants. The

selected plants should be dug out as soon as the largest of the tubers has grown to the size of a hen egg. The tubers should then be exposed to bright light until they have become quite green, after which they may be stored with safety. If blight is present on the foliage, the tops should be cut off before the tubers are dug. In the following year the produce of the selected plants should be grown in drills, among turnips or mangels, and care should be taken to keep the produce of each plant separate, planting it as far away as possible from other growing potatoes, as the virus is frequently carried by insects, or other means, from diseased to healthy plants. The produce of such only of those plants as appear healthy should be retained for future propagation.

(c) When purchasing seed care should be taken to secure the produce of a healthy crop.

Production of Healthy Stocks.—The desirability of procuring stocks of the principal commercial varieties free from virus diseases has been recognised for a considerable number of years.

As early as 1925 the Department took steps to have such stocks produced. A special officer was set apart for this work, which consists in the selection of apparently healthy plants during the growing period, the digging and boxing of the produce of these plants and the supervision subsequently of the growing of that produce in isolation. For various reasons the progress made has been necessarily slow. In the season 1929 the Plant Pathological Faculty of University College, Dublin, supplied the Department with a few tubers of each of the principal commercial varieties which had been grown and tested under greenhouse conditions for freedom from virus diseases. The produce of these is being carefully propagated and hopes are entertained that it may give rise to the most superior stocks in cultivation.

The Department furthermore award a special certificate under their Inspection Scheme for crops that, in addition to being pure and true to name, are free from virus and other hereditary diseases. Such crops must be grown not less than 50 yards distant from other potatoes.

Progressive seed potato growers should pay special attention to the production of healthy stocks, as the time is not far distant when buyers will demand a certificate of freedom from hereditary diseases.

Other Potato Diseases.

Potato Blight, generally referred to as "The Disease," can be almost completely controlled by early and efficient spraying, as referred to later. It is remarkable that a very large number of potato growers are not aware that the familiar "blackening" of the tubers which takes place before and for some time after digging, is due to blight.

Brown Scab.—In the case of ware potatoes, this scab is more a disfigurement than an injury—indeed its presence is often taken as indicative of good floury quality in the tuber; but in the case of seed it is, generally speaking, injurious. When it is present to any extent it is likely to be found on the eyes of the tubers, and in such cases the affected eyes will either not bud or will produce buds lacking in vigour. It is common knowledge that certain soils are more favourable to this disease than others. It is seldom to be found in soils possessing any degree of acidity. The application of lime, or even ashes, aggravates the disease, and hence lime should not be applied to the potato crop, but to some other crop in the rotation. Again, Brown Scab is found to be more prevalent in some seasons than in others; and certain varieties of potatoes appear to be more prone to it than others. Under the Seed Inspection Scheme, bags containing seed appreciably affected with Brown Scab will not be sealed by the Department's Inspectors.

Corky or Powdery Scab.—Except that it disfigures the tubers to a much greater extent, this disease may for all practical purposes be regarded as one with Brown Scab. Fortunately, however, it is not nearly so common in Ireland as the latter.

Rhizoctonia Solani.—This disease causes little damage in Ireland. The only varieties affected to any appreciable extent which have come under the writer's notice are Edzell Blue and Champion. The disease manifests itself on the skin of the tuber in the form of small black specks which can be readily detached with the finger nail. In the growing period it appears as a white collar around the stem at the ground level. This disease causes considerable damage in the U.S.A., but in this country so far as is known its effects are negligible.

Dry Rot is a disease which causes considerable loss among certain varieties during storage. It affects chiefly early varieties such as May Queen and Ninetyfold, and among second earlies, Catriona. The most effective preventives are (1) to green the tubers well by exposure to bright light as soon as possible after digging, (2) to avoid damage to tubers during digging, (3) to dig and store the tubers in good condition. Tubers grown on bog land appear to be less affected than those grown on other soils.

Skin Spot.—This disease affects potato tubers while in storage. Its seriousness lies in the fact that it may damage the eyes of seed potatoes and prevent their sprouting. Cases have occurred in England in which growers claimed compensation from seed suppliers for loss of crop attributed to Skin Spot on the seed. In this country no case of failure due to this isease has been recorded so far.

The external characters of Skin Spot are not very striking. Pimples are veloped on the skin, which in the case of thick-skinned varieties are finitely raised, but the colour of the skin is not much altered. In the e of thin-skinned varieties the diseased areas are scarcely raised, but ist ... mall dark circular spots with a slightly raised centre, the area

being brown or black in colour. Often the spots or pimples occur so close to one another that they merge, and extend over a considerable area. During later stages the pimples may become ruptured and give the appearance of scabs. There is little known of the life history of this disease. No method of control has yet been determined.

The numerous other potato diseases which have been recorded, such as Sclerotinia, Botrytis, Sprain, Pink Rot, Verticillium Wilt, Silver Scurf, etc., do not seriously concern the seed potato grower in this country.

Scheme of Inspection of Growing Crops.

A Scheme for the inspection of growing crops in regard to their suitability for seed purposes was inaugurated by the Department in 1918. This Scheme has been developed to a considerable extent.

Under this scheme potato crops in certain districts which are regarded as specially suitable for the production of seed of good quality are inspected during the growing period with a view to the ultimate certification of the produce for seed purposes. The officers engaged on this work have strict instructions to reject any crops that fall short of the following requirements:—

(*a*) that the plants are vigorous, and free from any form of Mosaic disease that is obviously causing a reduction in yielding capacity.

(*b*) that they are completely free from Leaf Roll;

(*c*) that any plants affected with Black Leg are removed; and

(*d*) that all rogues and impurities are removed to the Inspector's satisfaction.

The two principal seed-growing areas are in the neighbourhood of Athlone and in County Donegal. Experience has proved, however, that good seed can be grown in almost every part of the Irish Free State provided sufficient care is taken to keep the stocks healthy. A trade in seed potatoes is being gradually developed in the Ballina District, County Mayo, in County Wexford, and in parts of Counties Louth, Cork and Galway.

Sealed Bags.

As already indicated, until recent years buyers had too frequently just cause for complaint in regard to the selection and grading of seed potatoes. To remedy this defect, the Department in 1925 instituted a voluntary scheme of inspection whereby growers can have the produce of certified crops inspected for grading and soundness when bagged and ready for despatch. Each bag, the contents of which are found to be satisfactory, is sealed by the Inspector; and a certificate is issued to cover each consignment. The success of the scheme has been greatly facilitated by the co-operation of the Railway Companies who carry such seed at specially reduced rates.

For their own protection purchasers of one cwt. and upwards of seed potatoes should purchase only seed sold in sealed bags.

Production of a Profitable Crop.

In order to produce a profitable crop, it is necessary to pay close attention to detail. Points deserving of special consideration are:—

Selection of a Suitable Variety.—The market must be the deciding factor in regard to variety. Growers should consult not their own likes or dislikes but the needs of buyers. The varieties most in demand at present (1930-31) are indicated on a previous page. As between these varieties demand varies somewhat from year to year, with corresponding variation in prices. For instance, over-production of seed of a particular variety for one or two seasons may cause the price of that variety to fall to a comparatively low figure. It usually follows that many growers drop that variety for a time, with the result that prices recover and the few who persevered with its cultivation receive remunerative prices. This happened very noticeably this season in the case of Eclipse, of which there was a shortage of supplies.

Selection of Seed.—Great care should be exercised in the purchase of seed. For many generations it has been accepted that a change of seed is beneficial, and practical experience proves this belief to be generally well founded. It is, however, also well known that a grower may change his seed and find himself with a worse stock than the one he discarded. If a change is to be of any advantage the seed procured must be the produce of a healthy, vigorous crop, free from Leaf Roll, Mosaic, etc. It has been found that a change of seed from worse to better land and from a colder to a warmer district is usually desirable. It is commonly believed that bog or moory soil produces the most vigorous seed. These beliefs are generally justified by results, though the reasons are not fully understood.

A grower who already possesses a reasonably healthy, vigorous stock should make an effort to improve it by selecting and digging out at an early stage of growth the most vigorous and productive plants, as previously explained.

Size of Seed.—When purchasing seed the grower should always specify a definite grade, whether he has a preference for "seed size" or "seed and ware." If generally adopted, this precaution would obviate the complaints so frequently made that undersized and oversized sets were supplied as "seed." The term "seed potatoes" may mean anything. The grade favoured by the overwhelming majority of English buyers is over 1¼in. and through 2in. A somewhat larger grade, viz., 1½-2¼in. is recommended for planting in this country as being the most economical size. In South Lancashire, and in many parts of the South of Ireland, growers prefer cut "sets." The merits of "cut" versus "whole sets" have been debated for many years. It is now pretty generally acknowledged that:—

(*a*) cut sets produce larger tubers, but not necessarily a heavier yield, than whole sets;

(*b*) whole sets are much less liable to miss than cut sets;

(*c*) cutting of the sets encourages certain diseases, notably Black Leg.

In certain cases when there is good demand for seed-sized tubers, it might pay growers to sell their seed-sized potatoes and used cut "sets" for planting their own crops.

It is worth noting that large tubers planted whole produce a heavier crop than small seed but also produce a very large proportion of small tubers. Very small whole seed, unless planted very closely, will produce a crop consisting of a small number of large tubers.

Sprouting.—Every grower who has suitable housing accommodation should box and sprout his seed. Apart from the fact that sprouting increases the yield by at least 30 cwts. per statute acre, it gives an excellent opportunity for removing "mixtures" in the seed. Identification of tubers while sprouting is possible by noting the colour of the sprouts. Sprouts may be purple or varying degrees of pink. All varieties showing purple in the skin of the tubers have purple tinted sprouts, whereas varieties showing pink in the tubers have pink sprouts. Furthermore, varieties having blue-purple flowers such as Golden Wonder or Champion have purple sprouts, and varieties with red-purple flowers, such as Up-to-Date or Sharpe's Express, have pink sprouts. (See remarks *re* Colour of Sprouts (p. 273)).

Cultivation.—No precise method of cultivation can be recommended as being the most suitable on every farm. The object to be aimed at is to keep the ground for the potato crop open and loose and to have all the cultivation done before the growth of the plant is too far advanced. Potatoes should not be grown too often on the same land, as small tubers left in the ground may result in potato plants being produced for several years, especially in light, dry soils. The Champion, and indeed several other varieties, will not succeed except on fresh land.

Planting.—A suitable width for drills is 26 inches, and only under exceptional circumstances is a greater width necessary. Experiments have shown that even where "sets" are placed 10 inches apart in the drills, the proportion of seed-sized tubers will be very small if the crop is well treated. Just as in the case of most other farming operations no hard and fast rule can be laid down as to the proper width apart at which to place the "sets." The size of the seed, the condition of the ground, and the variety, must be considered. Where potatoes are grown mainly for seed production the "sets" should not be placed more than 10 inches apart; in many cases a space of 6 inches would be quite sufficient.

Manuring.—In addition to a light dressing of farmyard manure many growers now apply to their potato crop from 1 to 2 cwts. sulphate of ammonia, 3 to 6 cwts. superphosphate, and 1 to 2 cwts. muriate of potash per statute acre. Where no farmyard manure (or seaweed) is available

crops can be grown equally well on artificial manure alone. Under such circumstances, except on bog land, where a lighter dressing of sulphate of ammonia will suffice, it is usual to apply from 2 to 3 cwts. sulphate of ammonia, 6 to 8 cwts. superphosphate and 2 to 3 cwts. muriate of potash per statute acre.

Spraying.—The importance of early and thorough spraying in this country cannot be over-emphasized. The plain fact is that except in the case of early and second early crops raised before the middle of July, a profit on the growing of potatoes cannot be made without thorough spraying. Admittedly there is an occasional season in certain districts where spraying may not be profitable, but in such a year potatoes are likely to be plentiful and cheap. The grower who neglects to spray early, thoroughly, and at least three times will have no potatoes to sell in seasons when they are scarce and dear.

In a backward season when the foliage is small, and the danger of blight appears imminent, it is advisable to spray for the first time, and possibly for the second time, with 4 lbs. bluestone and 5 lbs. washing soda to 40 gallons water, instead of the usual 8 lbs. and 10 lbs. respectively. The weaker solution will not check the tender growth. If the foliage is rank, a partial check from spraying will cause no serious injury. The full strength should be used for the last spraying. Prepared mixtures or powder sprays have not proved anything like so successful as the mixture recommended above.

Cutting and Removing Tops.—It is a common custom in parts of Scotland to cut and remove the tops of certain first early varieties grown for seed as soon as blight makes its appearance. The crop is usually not raised for some weeks afterwards. The practice has not been tried to any extent in this country, but it is certainly well worth trying, particularly with soft early varieties such as May Queen, Early Rose, etc., that blight readily. It is seed-sized, not large tubers, of such varieties that are wanted. A sound uniform crop of seed-sized tubers is much more valuable than large tubers with a considerable percentage diseased.

Digging.—Every grower is aware that, if at all possible, the crop should be lifted in dry weather. When this is found to be impossible special care must be taken in storage.

It was thought until recently that immature seed gave better results than mature seed. Experiments have now proved that there is nothing in this idea, but that in fact the reverse is the case, if the crop is grown in a district where virus diseases do not spread rapidly.

Potatoes are raised with a fork or spade, with the plough, or with a potato digger. In districts where the spade or *loy* is used there is generally trouble with cut tubers. The plough is probably the best means of raising the crop as it seldom causes any appreciable damage.

The potato digger is the method almost universally used amongst commercial growers. The machine, however, causes serious damage to the tubers. It is difficult to find a large tuber that does not show some injury. Some growers have found that by putting rubber tubing, or cloth bindings, on the prongs of the digger the number of damaged tubers is reduced.

Storing.—Seed potato growers when lifting the crop should separate the seed-sized tubers from the ware. It frequently happens that there is a good demand for seed when there is a poor demand for ware, or vice versa; and at such times it is a decided advantage, as regards labour and expense, to have had the two classes of tubers stored separately.

Potatoes may be stored in pits or in houses. The tubers keep fresher in pits, but during bad weather it is much easier to get the potatoes ready for marketing when they are stored in a house.

The best method of covering a pit is to put on a thin layer of " drawn " rushes on top of the tubers, then a covering of about 6 inches of soil, and a thin covering of rushes on top of the soil. This will keep them dry and safe against all weather likely to prevail in this country.

Identification of Varieties.

All growers should be able to recognise the varieties which they plant, and be able to remove any " rogues " that may appear in their crops.

Varieties are distinguished by characteristics of:—

1. Tuber.
2. Sprout.
3. Foliage.
4. Flower
5. Date of Maturity.

In some cases it is only by paying attention to details that " rogues " can be distinguished from certain varieties in which they occur. Kerr's Pink is the most notable example.

1. The Tuber.—Tubers may vary in the following aspects:—

(*a*) Shape.—Tuber shapes are usually classified as Round, Oval and Kidney. Tubers are classified as " Round " although they may be only approximately spherical. In some cases, *e.g.*, Great Scot, they are referred to as " Flattened Round." With some varieties, *e.g*,. Lochar, round and oval tubers may be found on the same plant. There is no clear cut line between round and oval, or between oval and kidney. Some tubers frequently classed as oval might be more correctly described as " oblong," *e.g.*, Ally. " Kidney " tubers include what might be termed " long oval," as well as pear-shaped tubers, *i.e.*, those which taper towards one end. It should be particularly noted, that in the case of every variety, tubers will occur which are not typical of the variety.

(*b*) Colour of Skin.—The colour of the skin may be white, yellow, purple, pink or red, white with pink or purple splashes. The pink or purple colour may some times appear only in the eyes.

A Kerr's Pink tuber found by the writer had the skin partly pink and partly purple with a clear cut line between the two colours. In the following season a purple eye produced purple tubers, a pink eye produced pink tubers, and the remainder of the tuber produced variegated tubers. Somewhat similar cases with other varieties are on record. The depth of colour, and the smoothness or roughness of the skin vary to some extent with the soil. Bog soil produces the deepest colour. "Sports" occur from time to time which vary considerably in colour from the original type. A Champion with a purple skin, an Arran Victory with an almost pure white skin, a Beauty of Bute with a pink skin, a Kerr's Pink with an almost white skin, etc., have been seen by the writer.

Many white-skinned varieties have given rise to russet-skinned types, viz., Maincrop (Langworthy) gave rise to Golden Wonder, Up-to-Date to Field Marshall, Great Scot to Sefton Wonder, etc.

(*c*) Flesh.—The colour of the flesh is often a useful and very reliable guide. Champion, an immune variety, has yellow flesh, whereas Invincible, a non-immune of inferior quality, has white flesh, but the tuber otherwise resembles Champion and might easily be mistaken for it. The colour of the flesh may be classed as white, lemon and yellow, but there is no disinct line of demarcation between them. The flesh of Snowdrop is snow white, while Champion stands at the other extreme with decidedly yellow flesh.

(*d*) Eyes.—The eyes may be shallow, medium or deep. The position of the eyes on the tuber is also important. Duke of York, for example, has the eyes mostly on the point of the tuber, Great Scot on the shoulder of the tuber, while some of the old varieties such as Irish White have deep eyes scattered over the tuber.

The distinctness or otherwise of the eyebrow should be noted.

In addition to the foregoing characteristics of the tuber, certain purple-sprouted varieties show a purple colouring on the underground stem at the point where it is attached to the tuber. The underground stems of Abundance show distinct purple colouring, whereas those of British Queen are colourless.

It is well to note that in the great majority of cases it is quite impossible to identify a variety from the tuber alone.

2. The Sprout.

The colour of the sprout is a most reliable mark of identification, and if seed is sprouted before planting mixtures can be seen and removed without difficulty.

Sprouts are purple or pink in varying depths of colour. The sprout of British Queen is, for example, faint pink at the base with a white tip, while the whole sprout of Great Scot is deep pink. The depth of colour will to a certain extent vary with the amount of exposure to light. Long exposure to bright light will make the sprouts green, and render identification impossible. Under ordinary housing conditions, however, no difficulty will be experienced in identifying the colour.

The colour of the sprout corresponds with any colour present in the skin of the tuber. Furthermore, a variety with a blue purple flower will have a purple sprout while a variety having a red-purple flower will have a pink sprout. The strength and thickness of the sprout are also a guide. Again, some sprouts that may be identical in colour can be distinguished by the presence or absence of fine hairs. The sprout of Arran Comrade is covered with such hairs, whereas the sprout of Arran Chief is practically free from them.

3. Foliage.

Foliage characteristics are the most important means for the identification of varieties. In many cases it is a comparatively simple matter to recognise varieties from the foliage alone. The following features of the foliage serve as means for identification:—

(*a*) **Habit of Growth.**—The haulm may be tall or short, upright or spreading, stiff and erect or dropping and straggling, strong growing or weak, etc. Great Scot has erect foliage, while British Queen has a spreading haulm. Many varieties show a pronounced straggling habit of growth when the plants are affected with Mosaic disease. Great care is necssary to remove " rogues " with low-growing foliage from a tall-growing variety. Reading Russet among Kerr's Pink is an example. It should be noted that plants known as " Bolters " and also " Wilding " plants differ very materially from the normal type. (See " Bolters.")

(*b*) **Leaf.**—The potato plant has a compound leaf, made up of a number of leaflets attached in pairs to a central midrib with one terminal leaflet. There is also a number of much smaller leaflets known as secondary leaflets attached to the central midrib.

The leaves of some varieties have a much closer and more compact appearance than those of other varieties due to (1) the extra development either in size or number, or both, of the secondary leaflets, or (2) to there being a shorter space between each pair of leaflets on the central midrib, or (3) to the stalk by which the leaflet is attached to the central midrib being longer or shorter. Arran Consul has a most typical open leaf, with very long leaflet stalks; Abundance and Irish Queen have typical close leaves. In a considerable number of varieties it is difficult to say whether the leaf should be classed as " open " or " close." However, in many other cases it is a useful distinction.

The following points in regard to the leaf should be noted:—

Length of Leaf.—The lower leaves that are fully developed should be examined. White City and Arran Crest have remarkably long leaves.

Number of Leaflets in each Leaf.—President generally has two pairs of well-developed leaflets, whereas most varieties have three pairs.

Erect or Drooping Appearance, more particularly of the upper leaves: the upper leaves of Arran Chief are stiff and erect, while the leaves of "Great Scot" are more or less drooping.

Position of the Leaflets in regard to the Central Midrib.—In some leaves the leaflets stand out at right angles to the central midrib, in others they come off at an acute angle and are pointing forwards with the first pair usually overlapping the terminal. In such leaves the terminal may become united to one or to the first pair of lateral leaflets.

Colour of Leaflets.—Dark or light green, greyish or bluish green, and yellowish green sometimes seen on young growth. The surface of the leaflets may be hairy or glabrous, dull or glossy, wrinkled or smooth.

Size and Shape of the Leaflets.

Colour of Central Midrib.—Colour of leaflet stalk and midrib of leaflet should be noted.

Secondary Leaflets.—The number, size and shape of the secondary leaflets are useful factors for identification.

(*c*) **Stem.**—Stems of different varieties vary considerably in colour. In general, varieties having coloured tubers develop most colour in the stem. As a rule also colour develops towards maturity. Epicure and Eclipse (white tubers) develop as much colour as almost any variety with coloured tubers. As might be expected, stems of plants that are well exposed to bright light develop much more colour than plants not so exposed. Stems also vary in number, thickness, hardness, and branching or non-branching habit. The Champion variety produces a large number of thin wiry stems. Most varieties have hollow stems, except Eclipse, which has a solid stem until the plant is beginning to ripen.

The stem in some cases affords one very valuable point of identification. The stem of a potato plant is not round, but more or less three-sided, and at each angle a projecting ridge known as the wing runs up the stem. The edge of this ridge may be quite straight and even like a knife edge, as in the variety Great Scot, or it may be wavy or wrinkled as in the case of Arran Chief. Some varieties have a very broad wing as in Beauty of Bute. The wing is sometimes double as is very noticeable in the old variety Sackfiller.

4. Flower.

The flower, if present, usually affords great assistance in the identification of varieties. Flowers may be white, purple or almost blue.

White Flowers.—There are slightly different shades of white, but as a rule in practice the only points that can be observed are the presence of green tips, as in Arran Chief, and a slight trace of colour on the back of the petals, as in Flourball and Shamrock.

Purple Flowers.—Purple flowers may be divided into two classes, blue-purple, those in which blue predominates and red-purple, those in which red predominates. In both classes there are numerous different shades. Champion has a decidedly blue-purple flower, while the deepest red-purple flowers are produced by Sharpe's Express and Bishop.

Cases occur of varieties which normally have red-purple flowers, *e.g.*, Up-to-Date, President, producing white flowers.

Blue Flowers.—No potato flowers are pure blue, but certain flowers appear to be nearer to a pure blue than to any other colour. Comparison with a good colour chart will show that they are not blue. None of the common commercial varieties have apparently a blue flower, but there are a number of rare varieties that have apparently blue flowers, such as Cavan Lumper, Sharpe's Victor, Blight Resister, Bloomers, Buffs, Dunvegan, etc.

Apart from the colour of the flower, many other important points of difference may be discerned. The potato flower, like most flowers, is made up of four parts named as follows:—

(*a*) Calyx, comprised generally of five sepals.

(*b*) Corolla, comprised generally of five petals.

(*c*) Stamens or male portion of the flower.

(*d*) Pistil or female portion of the flower.

(*a*) The Calyx, or outer portion, is the part seen before the bud opens. It shows variations in colour, as the bud of Arran Chief is almost green while the bud of Great Scot has a distinct pink tinge. If the two buds are compared the difference in colour is readily seen. Peerless and Arran Victory can also be distinguished by the colour of the buds. The Calyx will also show some differences in the presence or absence of hairs on the sepals, in the length of the sepals, etc.

(*b*) The Corolla or brightly coloured part of the flower varies in colour and in the size and number of the petals. The colour, as already indicated, may be white, purple or almost blue. The tips of the petals are always lighter in shade and are frequently white. The colour must be looked for on newly opened flowers, as it fades rapidly when exposed to bright light. The flower of Tinwald Perfection when newly opened is quite distinct from

Up-to-Date, but it soon fades to a similar shade. Flourball, Irish White, May Queen, etc., have large petals, while Golden Wonder has small petals. May Queen has very frequently a variation in the number of petals.

(c) A Stamen consists of a short thread-like stem with an elongated bulbous top known as the anther. The anthers generally number five, and may vary in colour from orange or deep yellow to a very pale yellow. This difference in colour of the anthers is an extremely useful means of identification, and is very regular, although occasionally deep yellow and pale yellow anthers may be found on the same plant, *e.g.*, Early Rose, etc. The anthers are sometimes malformed. Paleness in colour and malformation usually coincide. The anthers of Arran Victory are pale and malformed whereas those of Peerless are deep yellow and regular. The Champion sometimes shows a very characteristic malformation of the anthers while at other times they are normal. Arran Chief, Ally and several other common varieties have malformed anthers.

Occasionally an anther develops into a petal. "Lord Roseberry" frequently shows this alteration.

(*d*) The pistil consists of a small bulb with a protruding stem known as the style. The flattened top of the style is known as the stigma. The length of the style and the distance which the stigma protrudes beyond the top of the anthers are in some instances useful guides. The stigma in the case of British Queen is about level with the top of the anthers, while in Abundance, a variety somewhat similar in flower and foliage, the style protrudes about one-eighth of an inch over the top of the anthers.

In addition to the above characteristics there are other points that may be worth noticing in connection with the flower. Potato flowers are seldom formed singly, but in clusters sometimes containing a dozen or even more flowers. The length, colour and the presence or absence of hairs on the flower cluster stalk should be noted. The same remarks apply in regard to the individual flower stalk. If the flower stalk is short the buds are usually carried in a horizontal or erect position as in the case of Great Scot. This type of flower cluster is usually found in varieties in which the buds drop before opening. If the flower stalk is long the buds are held in a drooping position as in the case of British Queen.

Again, some varieties such as British Queen and Up-to-Date bloom very freely, others such as Duke of York produce an occasional flower, while others such as Great Scot, King Edward, etc., seldom bloom. In certain seasons the seldom-flowering varieties bloom more freely than normally.

A haulm damaged through mechanical injury will frequently produce flowers, when the uninjured plant would not do so. This is very noticeable in the case of varieties that rarely bloom such as Sharpe's Express, Great Scot, etc. Bolters always bloom much more freely than normal plants.

Berries.—The natural production of berries sometimes serves as a point of identification.

5. Date of Maturity.

If a variety happens to ripen earlier or later than another, it is often possible to distinguish them with comparative ease. Thus, in the case of Tinwald Perfection, an immune variety, and the well-known susceptible variety Up-to-Date, the latter is slightly later in ripening, and its foliage may be noticed generally bearing some bloom, standing high above the Tinwald foliage, when the latter crop is ripening off. Arran Chief may be noticed in the same way in a crop of Great Scot.

Bolters and Wildings.

Frequent reference is made to plants known as " Bolters." These plants should be treated in all cases as " rogues." They are particularly objectionable when they occur among early varieties as they are from 6 to 8 weeks later in ripening. A " Bolter " plant is distinguished from the normal plant by the following characteristics:—(*a*) Production of a much greater amount of bloom, (*b*) much taller with a more open type of haulm showing a considerable amount of bare stems, (*c*) coarser tubers, (*d*) later ripening. The produce of " Bolter " plants always produces " Bolters." As a rule, they are not noticeable until well on in the season.

" Wilding " and " Witches Broom " are probably synonymous terms. The latter name is probably more applicable, as it denotes to some extent the condition of an affected plant. A " Wilding " plant produces a very large number of thin spindly branches generally all arising from one primary shoot of the seed tuber. As many as 200 branches have been counted on one plant. The plant is bushy and low in habit. The leaf of the " Wilding " is generally composed of a terminal leaflet and a very small number of lateral leaflets. The leaflets are not normal in shape, but always more or less rounded. The secondary leaflets practically disappear. Underground the number of stolons is greatly increased, and as many as 400 or even more tubers may be produced, very diminutive in size. A condition known as " Semi-Wilding " more frequently occurs, when some stems of the plant are normal, and others show the true Wilding condition.

Wildings rarely produce bloom, and even if they do so the flowers are very rudimentary. As in the case of Bolters, the tubers from Wilding Plants produce Wildings.

The cause of plants assuming the Bolter or Wilding condition is unknown.

Wilding plants should always be removed from crops intended for seed purposes. They rarely occur in this country.

LIST OF NAMES APPLIED TO POTATOES GROWN IN IRELAND, THEIR IMMUNITY (I) OR SUSCEPTIBILITY (S) TO WART DISEASE (BLACK SCAB) AND WHETHER DISTINCT VARIETIES OR MERELY SYNONYMOUS WITH SOME OTHER VARIETY.*

NAME.	IMMUNE (I) OR SUSCEPTIBLE, (S.)	(D.) DISTINCT VARIETY OR SYNONYMOUS WITH.
Abundance	I.	D.
Achievement	I.	D.
Adirondack	I.	D.
Advancer	I.	Bishop.
Allanah	I.	D.
Allies	S.	Northern Star.
Ally	I.	—
America	I.	Irish Cobbler.
Apple (Red)	—	D.
Ardcairn Beauty	I.	Beauty of Bute.
Ardneill Rose	I.	Early Manistee.
Argyle Favourite	I.	D.
Arran Banner	I.	D.
Arran Beauty	S.	British Queen
Arran Chief	I.	D.
Arran Comrade	I.	D.
Arran Consul	I.	D.
Arran Crest	I.	D.
Arran Early	I.	Abundance.
Arran Early	S.	British Queen.
Arran Hope	S.	Up-to-Date.
Arran Pilot	I.	D.
Arran Rose	I.	D.
Arran Treasure	I.	Ally.
Arran Victory	I.	D.
Ashleaf Kidney	S.	Myatt's Ashleaf Kidney.
Barley Bounty	I.	D.
Beauties	S.	D.
Beauties	I.	Beauty of Bute.
Beauty of Bute	I.	D.
Beauty of Hebron (Pink)	S.	D.
Beauty of Hebron (White)	S.	Puritan.
Ben Cruachan	I.	D.
Ben Lomond	I.	D.
Bishop	I.	D.
Black Bull	I.	Bloomers.
Black Champion	I.	D.
Black Skerry	S.	D.
Blight Resister	S.	D.
Blight Defender	S.	Green Champion.
Blight's Defiance	S.	Invincible.
Bloomers	I.	D.

* See Varieties of Potatoes with their Synonyms issued by the National Institute of Agricultural Botany, 1925. Published by W. Heffer & Sons, Ltd., Cambridge, 1/6d. nett., and List of Names of the Varieties of the Potato known to have been grown or tested in Great Britain, together with their Synonyms, published, 1924, by the Scottish Department of Agriculture, Queen Street, Edinburgh, price 2/6d.

NOTE.—The meaning of the word "synonym" as used in relation to Potato Varieties has been defined by the Ormskirk Synonym Committee as follows:—"Two varieties are considered to be synonymous when all such morphological features as can be recognised by an experienced observer, as well as all such physiological characters as can be determined by ordinary observation and experience, are common to both, in fact when the characters of haulm, flower and tuber, as well as maturity resistance to disease and particularly immunity or otherwise to Wart Disease, are the same in both."

Name.	Immune (I) or Susceptible, (S.).	(D.) Distinct Variety or Synonymous with.
Blue Grey	S.	D.
Blue Gloss	I.	D.
Blue Nebs	S.	D.
Blue Eyes	I.	Earl of Essex.
Bobbie Burns	S.	D.
Boston Kidney	I.	D.
Bravo	S.	D.
British Premier	S.	Epicure.
British Queen	S.	D.
Brown Blacks	I.	Bloomers.
Brown Champion	S.	Green Champion.
Brown Rocks	I.	D.
Bruce	S.	Magnum Bonum.
Buchan Beauty	I.	D.
Buffs	I.	D.
Cardinal	I.	D.
Catriona	I.	D.
Catriona Substitute No. 1	S.	D.
Catriona Substitute No. 2.	S.	D.
Cavan Lumper	S.	D.
Champion	I.	D.
Champion II.	I.	D.
Champion, Black	I.	D.
Champion's Heir	S.	D.
Champion, Brown	S.	Green Champion.
Champion, Green	S.	D.
Champion, Skerry	I.	Buchan Beauty.
Champion, Striped	I.	Buchan Beauty.
Champion Gardenfiller	I.	Buchan Beauty.
Champion, Purple	I.	Champion Selection.
Champion, Wild	—	—
Champion Successor	I.	Like Early Market Bolters.
Claymore	I.	D.
Clifden Seedling	I.	Champion II.
Climax	I.	The Towse.
Colleen	S.	British Queen.
Colonist	D	Eclipse.
Colossal	I.	D.
Conquest	I.	D.
Conquest	S.	Up-to-Date.
Copper Duns	I.	Earl of Essex.
Corona	I.	D.
Coronation	I.	D.
Crimson Beauty	I.	D.
Crusader	I.	D.
Cups	I.	Red Cups.
Cups, Gregor	I.	D.
Dainty	I.	Abundance.
Dalhousie	S.	Up-to-Date.
Dalmahoy	—	D.
Dargill Early	I.	Boston Kidney.
Di Vernon	I.	D.
Dominion	I.	D.
Don	I.	D.
Doon Star	I.	D.
Dreadnought	I.	Colossal.
Dreadnought	I.	D.
Dreadnought	I.	Templar.
Dreadnought	I.	Great Scot.
Duchess of Cornwall	S.	Up-to-Date.
Duke of Perth	I.	D.
Duke of York	S.	D.

Name.	Immune (I.) or Susceptible, (S.)	(D.) Distinct Variety or Synonymous with.
Dunnotar Castle	S.	D.
Dunaverney	I.	D.
Dunvegan	I.	D.
Earliest of All...	S.	Sharpe's Express.
Earl of Essex	I.	D.
Early Favourite	S.	Sharpe's Express.
Early Manistee	I.	D.
Early Market	I.	D.
Early Ohio	S.	D.
Early Pink Champion	I.	D.
Early Puritan	S.	Puritan.
Early Regent	S.	D.
Early Rose	S.	D.
Early Templar	I.	D.
Eclipse	S.	Sir John Llewelyn.
Eclipse	S.	Up-to-Date.
Edgecote Purple	S.	D.
Edinburgh Castle	S.	D.
Edzell Blue	I.	D.
Edzell Blue Substitute	S.	D.
Eightyfold	S.	D.
El Dorado	S.	Evergood.
Elephant	S.	D.
Elephant	S.	Pink Beauty of Hebron.
English Beauty	S.	British Queen
Epicure	S.	D.
Evergood	S.	D.
Factor	S.	Up-to-Date.
Farish's Pink Champion	S.	D.
Farmers	I.	D.
Farmer's Glory	I.	Earl of Essex.
Farmer's Glory	S.	Up-to-Date.
Field Marshall	S.	Russet Up-to-Date.
Fiftyfold	S.	D.
Flounder	S.	D.
Flourball	I.	D.
Flowers of Faughart	S.	Oxford Early.
Fluke	—	D.
Fortyfold	S.	D.
Gardenfiller	S.	Hibernia.
Garton's Potato	I.	Early Market.
Gawkies	I.	D.
General	S.	White-flowering President.
Gigantic	I.	D.
Glencoe	I.	D.
Golden Wonder	I.	Russet Maincrop.
Good Hope	S.	Up-to-Date.
Gordon Castle	S.	D.
Grampian	I.	Red Potato.
Great Scot	I.	D.
"Great Scot" Rogue	I.	D.
"Green Budded" Rogue	I.	Appears Distinct.
Green Champion	S.	D.
Green Mountain	I.	D.
Green Tops	I.	White or Brown Rock.
Gregor Cups	I.	D.
Greys...	I.	Buchan Beauty.
Greys...	I.	Black Champion.
Guardian	S.	Royal Kidney.
Haddingtons	S.	D.
Harbinger	S.	D.

Name.	Immune (I.) or Susceptible, (S.).	(D.) District Variety or Synonymous with.
Herald	I.	D.
Herd Laddie	S.	D.
Hibernia	S.	D.
Home Rulers	S.	Hibernia.
Immune Ashleaf	I.	Juli.
Imperator	S.	D.
Incomer	I.	D.
International Kidney	S.	D.
Inverness Favourite	I.	D.
Invincible	S.	D.
Irish Chieftan	I.	D.
Irish Cobbler	I.	D.
Irish Queen	I.	D.
Irish Strain	I.	D.
Irish White	S.	D.
Jeannie Deane	I.	Abundance.
Jersey Royal	S.	International Kidney.
John Bull	S.	D.
Juli	I.	Immune Ashleaf.
Katie Glover	I.	D.
Keay's Champion	I.	D.
Kemps	—	—
Kepplestone Kidney	S.	D.
Kerr's Pink	I.	D.
King Edward VII.	S.	D.
King George V.	I.	D.
K. of K.	I.	D.
Laing's Imperial	S.	Up-to-Date.
Lancers	I.	Red Potato.
Land Leaguers	S.	Hibernia.
Langworthy	I.	Maincrop.
Lapstone Kidney	—	D.
Leathers	I.	Brown Rock.
Leathercoats	I.	Brown Rock.
Leinster Wonder	I.	D.
Lochar	I.	D.
London Blue	S.	D.
Lord Roseberry	S.	D.
Lord Scone	I.	D.
Lord Tennyson	I.	D.
Lumper	I.	D.
Lymm Grey	S.	D.
Magnum Bonum	S.	D.
Maincrop	I.	D.
Mainstay	S.	British Queen.
Majestic	I.	D.
Marquis of Bute	I.	D.
Mauve Queen	I.	D.
May Queen	S.	D.
Mein's Early Round	S.	D.
Merricks	I.	D.
Midlothian Early	S.	Duke of York.
Millar's Beauty	I.	D.
Mill Street Hero	S.	D.
Mons Star	S.	Red King Edward
Moore's Fancy	I.	Dreadnought.
Mr. Bresse	I.	D.
Myatt's Ashleaf Kidney	S.	D.
New Era	S.	D.
New Success	S.	Duke of York.
Ninetyfold	S.	D.

Name.	Immune (I.) or Susceptible, (S.).	(D.) Distinct Variety or Synonymous with.
Ninetyeights	I.	Beauty of Bute.
Nithsdale	I.	D.
Norna	I.	D.
Northern Star	S.	D.
Open-Leaved Rogue from Kerr's Pink ...	—	D.
Orange-Anthor Substitute	S.	D.
Ormsby Choice	S.	D.
Osborne Seedling	I.	Abundance.
Oxford Early	S.	D.
Ox Noble	—	—
Paterson's Victoria	—	D.
Peacemaker	S.	British Queen.
Peacemaker	I.	Golden Wonder.
Peach Bloom	I.	D.
Peerless	I.	D.
Pink Eyes	I.	D.
Pink Eyes	I.	Beauty of Bute.
President	S.	D.
Pride of Bute	I.	D.
Priory Queen	I.	Abundance.
Prolific	I.	Snowflake.
Prolific	S.	Up-to-Date.
"Protestants"	I.	Rocks.
Puritan	S.	White Beauty of Hebron.
Purple Champion	I.	Champion.
Queen Mary	S.	Royal Kidney.
Queen Mauve (Also see Mauve Queen) ...	S.	Green Champion.
Queen of the Veldt	S.	D.
Raeburn's Gregor Cup	I.	D.
Rafters	S.	D.
Raheen Pride	—	D.
Ranfurly Red	I.	D.
Reading Russet	S.	D.
Rector	I.	D.
Red Apple	—	D.
Red Cross	I.	D.
Red Cups	I.	Cups.
Red Flounder....	I.	Red Potato.
Red King	S.	Selection King Edward.
Red Nosed Kidney	—	—
Red Potato	I.	D.
Red Rocks	I.	D.
Rehedee	S.	Black Skerry.
Renown	I.	Abundance.
Resistant Snowdrop	I.	Snowdrop.
Rhoderick Dhu	I.	D.
Rocks (White, Brown and Red) ...	I.	D.
Royalty	S.	British Queen.
Rogue Like Cardinal	—	D.
Rogue Like May Queen	S.	D.
Royal Kidney	S.	D.
Ruby Queen	S.	D.
Russet Rural	S.	Russet Rural. New Yorker.
Rural New Yorker	S.	D.
Sackfiller	S.	D.
St. Malo	I.	D.
Schoolmaster	I.	D.
Schoolmaster	I.	Purple Champion.
Scottish Chief	I.	D.
Scottish Farmer	S.	President.

Name.	Immune (I.) or Susceptible, (S.).	(D.) Distinct Variety or Synonymous with.
Scottish Triumph	S.	Up-to-Date.
Seery's Surprise	S.	Beauty of Hebron.
Sefton Wonder	I.	Russet Great Scot.
Shamrock	I.	D.
Shaun Power	I.	Earl of Essex.
Sharpe's Express	S.	D.
Sharpe's Victor	S.	D.
Sharpe's Pink Seedling	I.	D.
Silver Shamrock	I.	Champion II.
Silver Skins	I.	White Rocks.
Sim Grey	S.	Lymm Grey.
Sir John Llewelyn	S.	Eclipse.
Skerry	S.	Black Skerry.
Skerry Blue	—	—
Skerry Champion	I.	Buchan Beauty.
Snowdrop	I.	D.
Snowflake	I.	D.
Southampton Wonder	I.	Great Scot.
Spry's Abundance	S.	D.
Stirling Castle	S.	D.
Stouter	I.	Bloomers.
Striped Champion	I.	Buchan Beuaty
Summit	S.	D.
Sutton's Abundance	I.	Abundance.
Templar	I.	D.
The Baron	I.	D.
The Towse	I.	D.
Thomes	I.	D.
Thome Black	I.	D.
Tinwald Perfection	I.	D.
Toley	S.	D.
Torquil	I.	Catriona.
Tremendous	S.	Up-to-Date.
Tremendous	I.	Great Scott.
Up-to-Date	S.	D.
Utility	I.	D.
Victoria (Paterson)	—	D.
Victory	S.	Duke of York.
Village Blacksmith	S.	D.
Vitality	S.	D.
Vitality	S.	Arran Chief.
Waverley	S.	D.
What's Wanted	I.	Maincrop.
White City	I.	D.
White Pebble	I.	Abundance.
White Rocks	I.	D.
Windsor Castle	S.	D.
Witchhill	I.	Snowdrop.
Woodstocks	S.	Up-to-Date.
Yam	S.	D.
Yankee	S.	D.
Yankee Baby	I.	D.
Yellow Potato	I.	Brown Rock.

The foregoing list contains the names of all the principal varieties that are or have been in commerce for the past thirty years.

The concluding portion of this Article, viz., a description of every variety of potatoes grown in Ireland, including characteristics of foliage, flower and tuber, will appear in the next issue of this Journal.

SEED PROPAGATION, 1930.

Report on the Work of the Seed Propagation Division of the Department of Agriculture, 1930.

As in the previous season the propagation of parent stocks of barley was continued at the Department's Cereal Station at Ballinacurra, Co. Cork, and in addition extension work with oats, barley and wheat was continued under the Department's control. Propagation of parent stocks of wheat and oats was continued at the Albert Agricultural College, Glasnevin, under the supervision of the staff of the Agricultural Faculty of University College, Dublin. Particulars of the work conducted under the Department's control during the season of 1930 are embodied in this report, and an account of the work carried out at the Albert Agricultural College will be found elsewhere in this Journal.

WEATHER CONDITIONS IN 1930.

The weather during the period from November, 1929, to the end of January, 1930, was exceptionally wet, with the result that soils were in bad condition, and tillage operations backward at the beginning of Spring. February was a comparatively fine dry month, but the rainfall throughout the month of March was excessive, and little sowing was done, except on the lighter types of soils, until early in April. The period from mid-April to mid-July was fine and dry, with plenty of sunshine. From the latter date until the end of the harvest season the rainfall was excessive, and in many areas corn crops lodged badly. Weather conditions during late Spring and early Summer were not conducive to rapid growth, and the exceptionally wet weather which prevailed during late Summer and Autumn delayed ripening and rendered harvesting operations more troublesome than usual. Notwithstanding the unfavourable weather conditions which prevailed throughout the season, the quality of the grain produced in most districts was well up to the normal standard. Many samples were, however, damaged and discoloured as a result of the prolonged period of harvesting.

Barley.

The Department again had the close co-operation and assistance of Messrs. A. Guinness, Son and Co., Ltd., at whose Experimental Maltings the produce of the various experimental lots was analysed and malted. All seed sown at the Ballinacurra Cereal Station, and all seed distributed from it was treated for the prevention of Smut (Ustilago Hordei). As in the previous year, the effect of this treatment was highly satisfactory, for no Smut was found in the crops grown from this treated seed. Stripe disease (Helminthosporium) was not nearly so prevalent as in the previous season.

Propagations.

(a) Pure Lines and Hybrids.

In 1929 a new method of selecting seed for the further pure line propagation of Spratt-Archer 37 No. 3—the variety now distributed under the

Department's scheme for the distribution of pedigree seed barley—was introduced. Instead of selecting, as hitherto, a single plant, ten grains and an entire single ear were taken from every fifth plant in the single line cultivation of 1929. In the Spring of 1930 five grains from each ten grain lot were sown in separate lines, the remaining five grains from each lot being kept in reserve. In addition, the produce of each single ear was sown separately in corresponding lines. The produce of each of these latter lines will be further propagated solely for the purpose of producing sufficient grain for small scale malting tests. If, as a result of these tests, the produce of any single plant is found defective, the entire lot of the defective stock can be removed before the produce from the original five grain lots is bulked to provide seed for garden plots. With this method it will be possible to detect defects at an early stage.

Besides the selections of Spratt-Archer 37 No. 3, fifty-eight single plant selections, consisting of all the best known varieties in cultivation, together with a number of hybrids, and selections from old native stocks were grown in the cereal cage at Ballinacurra. There were also a number of the F2 generation plants from a new cross of Spratt-Archer and July-six-rowed. Thirty-nine garden plots were grown in the Rosehill North paddock, and fifteen field plots in the Rosehill Middle field.

(*b*) *First Pedigree Plots.*

The following are the names of the plot growers with the varieties and areas in each case :—

(1) Mrs. O'Brien, Loughatalia, Ballinacurra.

Archer-Goldthorpe 4/5/1 x Goldthorpe-Spratt 18/1.
Spratt-Archer 37 No. 3.
Spratt-Archer 37 No. 4.
D. S. K. Binder.
Spratt-Archer 37/6 x Goldthorpe-Spratt 18/1 No. 1.

The area of these plots was 1 statute acre each, with the exception of that of Spratt-Archer 37 No. 3, which was two statute acres.

(2) Mr. C. Deasy, Loughatalia, Ballinacurra.
Spratt-Archer 37 No. 3.
Abed Rex x Spratt-Archer 37/6 6/1.

The area of the former was 4 statute acres, and of the latter 1 statute acre.

(3) J. H. Bennett, Ltd., Ballinacurra.

July-six-rowed.
Archer.
Spratt-Archer 37/12/41.

These plots were one statute acre each.

(c) *Second Pedigree Plots.*

The second pedigree plots of Spratt-Archer 37 No. 3 were grown on the farms of the following:—

Denis Mulcahy, Ballintubber, Carrigtwohill, Co. Cork	15 acres.
Michael Kelleher, Geragh, Ballinacurra, Co. Cork	13 ,,
William McAuliffe, Carrigatoher, Midleton, Co. Cork	10 ,,
William S. McLachlan, Gleniris, Ballinacurra, Co. Cork	9 ,,
Thomas Cronin, Castleredmond, Ballinacurra, Co. Cork	3½ ,,
W. Smyth, Bridgefield, Castlemartyr, Co. Cork	10 ,,

The produce of these plots has been reserved for distribution under the Department's Scheme for the distribution of seed barley in 1931.

(d) *Distribution of Pedigree-seed.*

Under the Department's scheme for the distribution of pedigree seed barley, seed of Spratt-Archer 37 No. 3 was distributed as follows:—

	Brls.	Sts.
F. Codd and Co., Mountmellick, Leix	10	0
W. B. Nunn and Co., Castlebridge, Wexford	20	0
P. J. Roche and Sons, Ltd., Enniscorthy, Wexford ...	10	0
P. P. Roche and Sons, Ltd., New Ross, Wexford ...	20	0
J. H. Bennett, Ltd., The Maltings, Ballinacurra, Co. Cork	10	0
J. N. Greene, Mageney, Kildare	5	0
N. Loughlin, Fanisk, Ladysbridge, Co. Cork	10	0
E. Smithwick and Sons, St. Francis Abbey Brewery, Kilkenny	2	0
W. J. O'Keeffe and Son, Faythe Maltings, Wexford ...	5	0
F. A. Waller and Co., Ltd., Banagher	15	0
P. and H. Egan, Ltd., Tullamore	9	0
J. and A. Tarleton, Ltd., Tullamore	20	0
Mrs. Segrave, Dunaney, Dunleer, Co. Louth	5	0
R. Perry and Sons, Rathdowney	7	0
A. J. M. Reeves, Athgarvan Maltings, Newbridge ...	24	0
G. Read and Co., Roscrea	10	0
Capt. Whitehead, Birr Maltings, Birr	8	8
J. Watson and Co., Leighlin Bridge	10	0
J. Watson and Co., Carlow	15	0
D. and E. Williams, Ltd., Tullamore	30	0
D. and E. Williams, Ltd., Banagher	30	0
Minch Norton and Co., Ltd., Goresbridge	20	0
Minch Norton and Co., Ltd., Nenagh	25	0
Minch Norton and Co., Ltd., Athy	47	0
Minch Norton and Co., Ltd., Bagenalstown	30	0
P. O'Meara and Sons, Thurles	10	0
M. Kelliher and Sons, Tralee	10	0
James Behan, Monasterevan	5	0
J. M. Simpson, Ballymaloe, Cloyne, Co. Cork	9	10
Total	432	2

Inspection of Growing Crops.

The Department again arranged for the inspection of growing crops of Spratt-Archer with a view to ascertaining the suitability of the produce for seed purposes. The inspections were confined to crops grown from (a) seed supplied from Ballinacurra in 1930; (b) the produce of seed supplied from Ballinacurra in 1929; and (c) commercial Spratt-Archer seed. A total of approximately 3,487 acres was inspected, of which 631 acres were in class (a), 529.5 acres in class (b), and 2326.5 acres were in class (c). Of these 1.1% were rejected in class (a), 10.4% were rejected in class (b), and 15.8% were rejected in class (c). The crops rejected in class (a) were considered unsuitable because they had been sown in such close proximity to other cereal crops that the purity of the seed from the crop would be doubtful. In class (b) the crops were rejected on account of admixture with other varieties. Of the 369 acres rejected in class (c) smut was prevalent in 201 acres; an undue admixture of other varieties was present in 127 acres; 27 acres were sown in close proximity to another variety; 147 acres were badly infected with noxious weeds, and 43 acres were reported as likely to be of inferior quality.

The area inspected was less than in previous years, due chiefly to the fact that a comparatively small amount of pedigree seed was distributed in the previous year (1929). While the percentage of crops rejected in classes (a) and (b) was practically the same as that for last year, it should be noted that in no case in these two classes were crops rejected as unsuitable owing to the presence of smut. In class (c) the percentage rejected was much less than that of the previous year.

[TABLES.

TABLE I.

LARGE SCALE BARLEY VARIETY EXPERIMENTS, 1930.

Centre.	Name and Address of Grower.	Description of Soil.	Previous Crops.	Date of Sowing.	Date of Harvesting.
1	Mrs. Tait, Hermitage, Rostellan, Co. Cork ...	Loam ... ... Sub-soil, Shale ...	Oats 1928 ... Mangolds 1929 ...	April 11th ...	August 28th
2	Wm. Watkins, Coolnagrower, Fortal, Birr, Offaly ...	Light Loam ... ... Sub-soil Gravel ...	Barley 1928 ... Roots 1929	April 16th ...	Sept. 15th-20th
3	J. L. Nunn, Castlebridge, Wexford	Sandy Loam ... ... Sub-soil, Gravel ...	Barley 1928 ... Roots 1929	April 23rd and 24th	Aug. 23rd-Sept. 2nd
4	J. Fletcher, Cushmona, Dromineer, Co. Tipperary	Light Loam ... ... Sub-soil, Gravel and Limestone	Barley 1928 ... Roots 1929 ...	April 16th ...	Sept. 4th-5th
5	Mrs. Segrave, Dunany, Co. Louth	Light Loam ... ... Sub-soil, Gravel and Clay	Oats 1928 ... Roots 1929 ...	April 19th ...	Sept. 9th
6	N. Howlett, Ramsgrange, Co. Wexford	Stiff Loam ... ... Sub-soil, Shale ...	Oats 1928 ... Roots 1929	April 14th ...	Sept. 1st-4th
7	M. P. Minch, Rockfield, Athy, Co. Kildare ...	Deep Loam ... ... Sub-soil, Gravel ...	Barley 1928 ... Beet 1929	April 7th ...	Sept. 2nd
8	P. Byrne, Ballygrangans, Kilmore, Co. Wexford	Sandy Loam ... ... Sub-soil, Gravel ...	Barley 1928 ... Beet and Mangolds 1929.	April 17th ...	Sept. 2nd-4th
9	D. Morris, Tomahurra, Enniscorthy, Co. Wexford ...	Shaly Loam ... ... Sub-soil, Shale	Oats 1928 ... Roots 1929	March 26th ...	August 29th
10	Capt. Reeves, Athgarvan, Co. Kildare	Med. Loam ... ... Sub-soil, Limestone	Oats 1928 ... Roots 1929	April 18th ...	Sept. 15th-17th

TABLE II.

LARGE SCALE BARLEY VARIETY EXPERIMENTS, 1930.

Yield and Value of Grain per Statute Acre.

CENTRE.	ARCHER. Yield of Dressed Grain.	ARCHER. Value per Barrel.	ARCHER. Total* value includ-ing Screen-ings.	SPRATT-ARCHER 37 No. 3 Yield of Dressed Grain.	SPRATT-ARCHER 37 No. 3 Value per Barrel.	SPRATT-ARCHER 37 No. 3 Total* value includ-ing Screen-ings.	SPRATT-ARCHER 37 No. 4 Yield of Dressed Grain.	SPRATT-ARCHER 37 No. 4 Value per Barrel	SPRATT-ARCHER 37 No. 4 Total* value includ-ing Screen-ings.	SPRATT-ARCHER 37/12/41 Yield of Dressed Grain	SPRATT-ARCHER 37/12/41 Value per Barrel.	SPRATT-ARCHER 37/12/41 Total* value includ-ing. Screen-ings'	OLD IRISH. Yield of Dressed Grain	OLD IRISH. Value per Barrel.	OLD IRISH. Total* value includ-ing Screen-ings.
	Bls. Sts.	s. d.	£ s. d.	Bls. Sts.	s. d.	£ s. d.	Bls. Sts.	s. d.	£ s. d.	Bls. Sts.	s. d.	£ s. d.	Bls. Sts.	s. d.	£ s. d.
Cork Mrs. Tait	8 15	15 9	7 4 6	9 1	16 3	7 11 0	8 14	16 0	7 5 0	9 2	16 3	7 12 6	—	—	—
...*Offaly.* Wm. Watkins ...	8 13	16 3	7 4 8	9 11	16 3	7 18 11	9 9	16 9	8 1 8	10 15	16 9	9 4 8	—	—	—
Tipperary. J. Fletcher	9 8	16 9	8 0 4	11 11	17 0	10 0 2	11 12	17 0	10 0 9	11 14	17 0	10 4 4	—	—	—
Kildare. M. P. Minch	9 11	16 9	8 6 3	11 8	17 0	9 19 9	11 2	17 0	9 11 7	10 12	16 9	9 6 3	—	—	—
Capt. Reeves	5 11	13 6	4 0 3	10 0	14 6	7 8 6	11 10	15 3	9 2 3	12 4	14 0	8 15 9	—	—	—
Louth. Mrs. Segrave	11 7	16 3	9 8 10	12 15	16 6	10 15 11	12 9	16 6	10 10 0	12 7	16 3	10 4 7	—	—	—
Wexford. P. Byrne (i.)	7 8	15 9	5 19 7	7 4	16 0	5 17 6	10 10	16 3	8 13 11	10 12	16 3	8 16 8	—	—	—
N. Howlett	9 5	15 6	7 12 4	9 14	15 9	8 3 0	9 8	15 3	7 12 10	9 14	15 9	8 3 6	—	—	—
J. L. Nunn	9 6	16 3	7 16 1	11 5	16 6	9 9 11	10 7	16 6	8 14 11	10 10	16 3	8 16 5	10 2	15 9	8 1 9
D. Morris	8 12	16 6	7 6 7	18 9	17 0	7 6 10	8 1	17 0	6 19 4	8 14	17 0	7 12 7	—	—	—
Average of 9 centres omitting (i.).	9 1	—	7 8 10	10 8	—	8 14 11	10 6	—	8 13 2	10 12	—	8 17 10	—	—	—

*Screenings valued at 6d. per stone.

Large Scale Variety Experiments.

These experiments were conducted at ten centres, four of which were located in Co. Wexford, two in Co. Kildare, and one each in Counties Cork, Offaly, Tipperary and Louth. Four varieties, namely, Spratt-Archer 37 No. 3, Spratt-Archer 37 No. 4, Spratt-Archer 37/12/41 and Archer were grown at all centres. In addition, at one centre in Co. Wexford Old Irish was also included in the trial. The two varieties first-named have been included in these experiments for some seasons past. Spratt-Archer 37/12/41 was introduced because it had given fairly promising results in trials conducted at Ballinacurra Cereal Station in the previous year. As it has sometimes been put forward that Archer, a variety which was widely grown some years ago, was superior in yielding capacity to the strains of Spratt-Archer now grown, arrangements were made to propagate a pure line stock of Archer at Ballinacurra, and to include this variety in the large scale experiments in 1930. As Old Irish is a popular variety in Co. Wexford, it was decided to include it in the trials at one centre in that county.

The size of the plots was one statute acre except at one of the Co. Wexford centres, where they were three-quarters of an acre in size. The seed for all plots was drawn from the produce of the Department's first pedigree plots grown at Ballinacurra Cereal Station in 1929.

Table I. contains the names and addresses of the plotholders, together with particulars regarding the cropping of the land during the two previous years, the nature of the soil and subsoil, and the dates of sowing and harvesting. Table II. shows the yields of grain per statute acre as thrashed, the value per barrel of same as determined by independent buyers, and the total value of the grain, including screenings, per statute acre.

In the case of one of the centres in Co. Wexford it was discovered, after the plots were sown, that the land had not been uniformly treated as regards manuring in the previous season. Consequently the returns from this centre are not reliable, and they have not been taken into account in determining the average returns.

Practically similar returns were on the average produced by the three types of Spratt-Archer barleys included in the trials. Spratt-Archer 37/12/41 gave a slightly better average yield than the other two strains, but it has been found to be inferior to the latter in malting quality. The Archer variety produced a considerably lower average return than either of the three Spratt-Archer types. The remarkably low yield produced by Archer at one of the Co. Kildare centres, where the soil was comparatively rich, was mainly due to the fact that the variety lodged badly. At the same centre Spratt-Archer 37 No. 3 also lodged, but to a much lesser extent than Archer. Old Irish, at the one centre at which it was tested, proved superior in yielding capacity to Archer, but inferior to the Spratt-Archer types. The malting quality of the grain of Old Irish was again inferior to that of the other varieties included in the trials.

Small Scale Quantitative Experiment.

As in the previous year, the standard variety used in this experiment was Spratt-Archer 37 No. 3. Seven other varieties which had not previously been tried were also grown. The experiment was laid out in chessboard fashion, the arrangement being five squares abreast in twenty-four consecutive lines, each variety being replicated fifteen times.

The names of the varieties grown, together with a summary of the average yields and the average percentage of nitrogen for each variety are given in Table III.

TABLE III.

	Yield.	Average yield in grammes.	Average Percentage of Nitrogen.
1	Victory	144·95	1·53
2	Spratt-Archer 37 No. 3	135·94	1·44
3	Hybrid No. 4 A	135·42	1·43
4	Hybrid No. 7	132·01	1·41
5	A.G.4/5/1 x Spratt Archer 37 No. 3 ...	130·49	1·59
6	Spratt-Archer 37/6 x G.S.18/1 No. 2 ...	130·44	1·43
7	Donegal 2 rowed No. 2	128·55	1·52
8	Spratt-Archer 37/6 x G.S. 18/1 No. 6 ...	116·56	1·59

Victory was the only variety which gave a higher yield than the standard variety Spratt-Archer 37 No. 3. Its nitrogen content was, however, relatively high, and its malting quality decidedly unsatisfactory. Hybrid No. 44 was practically equal to Spratt-Archer 37 No. 3 both as regards yield and nitrogen content, and slightly better in malting quality. Hybrid No. 7 is the only other variety worthy of further trial.

Half Drill Strip Experiments.

Three experiments were carried out on the farm of Messrs. J. H. Bennett, Ltd. Spratt-Archer 37 No. 3 was used as the standard variety in Experiments Nos. 1 and 2; the other varieties included being Abed Rex x Spratt-Archer 37/18/ 6/1 and Archer-Goldthorpe 4/5/1 x Goldthorpe-Spratt 18/1. In experiment No. 3 two different generations of Spratt-Archer 37 No. 3 were compared. The results of the experiment are summarised in Table IV, from which it will be seen that both Abed Rex x Spratt-Archer 37/18 6/1 and Archer-Goldthorpe 4/5/1 x Goldthorpe-Spratt 18/1, particularly the latter, proved inferior in yielding capacity to the standard variety. Practically similar returns were produced by the two generations of Spratt-Archer 37 No. 3.

TABLE IV.

—	No. 1 Experiment.		No. 2 Experiment.		No. 3 Experiment.	
					S.A. 37	No. 3.
	S.A. 37 No. 3.	Abed Rex x S.A. 37/18/6/1	S.A. 37 No. 3.	A.G. 4/5/1 x G.S. 18/1	2nd Pedigree.	Field Plot.
Moisture per cwt. ...	19·6	20·1	20·1	21·4	20·7	20·7
Weight of 1,000 corns	37·0	38·2	38·2	41·8	38·2	38·3
Nitrogen per cwt. ...	1·19	1·13	1·13	1·19	1·22	1·25
Yield in lb. ...	36·68	35·04	39·27	30·54	45·36	44·68

The Influence of Nitrogenous Manures on the Quality of the Produce.

The arrangement of the experiment in 1930 was as follows:—Three plots of approximately 1/5th of a statute acre each were laid down on the farm of J. H. Bennett, Ltd. One was sown at the rate of 12 stones per statute acre, and two were sown at the rate of 4 stones per statute acre. One of these latter plots received two dressings of Sulphate of Ammonia at the rate of half a hundredweight per statute acre at each dressing. One dressing was applied at the time of sowing, and the other when the corn was brairded. In this plot two sub-plots of approximate 1 square perch each, were marked off, and in June, when the corn was well forward, a further dressing of Sulphate of Ammonia, at the rate of 1 hundredweight per acre, was applied to one of the sub-plots, and a dressing at the rate of 2 hundredweight per acre was applied to the other. As was to be expected, the crop on the plot which received the dressings of Sulphate of Ammonia grew very vigorously, but by harvest time there was little difference in the appearance of the crops on the different plots, except in those areas of the third plot where the extra manurial dressings were applied late in the season. On these sub-plots the barley grew tall and rank, and in the wet weather which followed, got very tossed and tangled.

Particulars of the yield obtained from the different plots and sub-plots and the results of the analyses of the different samples of grain are set out in Table V.

[TABLE.

TABLE V.

Plot.	Seeding Rate. Stones per acre.	Dressings of Sulphate of Ammonia applied per Statute Acre.				Yield.			Total Yield per plot.	Analysis.		
		At Sowing.	At Brairding.	In June.	Total.	Bls.	sts.	lb.		Moisture per cent.	1,000 Corn Weight.	Nitrogen per cent.
No. 1	12	None	None	None	None	2	12	7	2 12 7	16·5	38·7	1·35
No. 2	4	None	None	None	None	2	3	0	2 3 0	16·8	41·4	1·27
No. 3 ...	4	½ cwt.	½ cwt.	None	1 cwt.	2	10	0		16·4	42·6	1·28
Sub Plot A of 1 sq. perch				1 cwt.	2 cwt.	–	–	7	2 11 2	15·8	44·0	1·48
Sub Plot B of 1 sq. perch				2 cwt.	3 cwt.	–	–	9		15·2	43·3	2·14

It will be noticed that the plot seeded at the normal rate which received no nitrogenous manure gave a slightly better yield than the manured plot. The moisture content of the grain from the heavily-manured sub-plots was lower than that of the remainder of the plot or of the grain from the other two plots. It was only in the case of the sub-plot which received the extra heavy dressing of Sulphate of Ammonia that the nitrogen content of the grain increased to any marked degree.

OATS.

Propagations.

(*a*) *Field Plots.*

The produce of the two plots of Sandy which were grown last year at Ballinacurra Cereal Station was bulked and grown again this year in a large plot, next to which was grown an equal sized plot of Potato II, the seed for which was received from the Cereal Station at Glasnevin. (Potato II oats is a pigmented strain of potato oats somewhat resembling Sandy.) These two varieties were grown with two objects: first, to compare their yielding capacity, and second to propagate seed for distribution in those parts of County Donegal where Sandy is extensively grown.

The area of each plot was approximately 1/10th of a statute acre.

The yields of dried and screened grain were as follows:—

Sandy	1 brl. 0 sts.
Potato II	1 ,, 2 ,,

Unfortunately, the grain of Potato II was infected with smut (Ustilago Avenae.)

(*b*) *Extension Plots.*

A plot of one statute acre of Potato I was grown in the Ramhill field at Ballinacurra Cereal Station. The seed was obtained from the Albert Agricultural College Cereal Station. The yield of dried and screened grain off this plot was 8 brls. 7 sts.

(*c*) *Department's Large Extension Plots.*

In connection with the Scheme for the propagation of Pedigree Oats, plots of Victory II and Black Tartary were grown in the neighbourhood of Ballinacurra as follows:—

VICTORY II	14 acres on the farm of Cornelius Fitzgerald, Heamount, Carrigtwohill. 8 acres on the farm of Denis Mulcahy, Ballintubber, Carrigtwohill, Co. Cork.
BLACK TARTARY	7 acres on the farm of Thomas Twomey, Ballintubber, Carrigtwohill, Co. Cork. 2½ acres on the farm of David Barry, Ballintubber, Carrigtwohill, Co. Cork.

(d) County Extension Plots.

The seed of Black Tartary and Victory II for these plots was drawn from the produce of the Department's Large Scale Extension plots grown in the neighbourhood of Ballinacurra in 1929. The seed of Glasnevin Sonas (Banner Tartary 9) and Victory Mogul 12/2/1 was produced at the Albert Agricultural College, Glasnevin.

The produce of these plots should, where suitable, be available for seed in the Spring of 1931.

The names and addresses of the growers of these County Extension plots in 1930, the variety sown, and the quantity of seed supplied to each grower are set out in the following lists:—

Black Tartary.	Sts.
Miss H. O'Keeffe, Garryhesta, Ovens, Co. Cork	84
Timothy Goolde, Crookstown,, Co. Cork	56
J. O'Reilly, Kilgobbin, Bandon, Co. Cork	42
W. Wall, Upper Belmont, Crookstown, Co. Cork	28
J. Lehane, Crossmahon, Lissarda, Co. Cork	28
B. O'Donoghue, Knockduff, Millstreet, Co. Cork	28
J. McAuliffe, Knockduff, Millstreet, Co. Cork	28
John Magee, New Ross, Co. Wexford	14
R. Doyle, Broadway, Co. Wexford	14
J. Darcy, Limbrick, Inch, Co. Wexford	28
Mrs. Redmond, Tinnock, Gorey, Co. Wexford	14
Myles Mordaunt, Gorey, Co. Wexford	14
T. Cummins, Ramsgrange, Co. Wexford	14
J. Cullen, Boley, Ballycullen, Co. Wexford	14
A. Conway, Coolroe, Ballycullen, Co. Wexford	14
T. Griffin, Kilgobbin, Kinsale, Co. Cork	42
D. M. Downing, Ballincurrig, Co. Cork	56
D. Barry, Rathcormack, Fermoy, Co. Cork	42
J. Leahy, Castlelyons, Fermoy, Co. Cork	42
W. Barker, Tinahely, Co. Wicklow	28
J. Mulhall, Tinahely, Co. Wicklow	14
A. Merrigan, Avoca, Co. Wicklow	42
J. Kennedy, Tinahely, Co. Wicklow	28
W. Fahy, Glenisland, Castlebar, Co. Mayo	28
T. Kilcourse, Rocklands, Castlebar, Co. Mayo	14
P. Doyle, Craans, Tullow, Co. Carlow	56
Mrs. Donohoe, Myshal, Co. Carlow	28
T. C. Tynan, Johnstown, Ballybrophy, Laoighis	84
M. Purcell, Fortwilliam, Clonmel, Co. Tipperary	42
W. Prendergast, Derrygrath, Clonmel, Co. Tipperary	42
M. Crowley, Leap, Skibbereen, Co. Cork	32
J. Walsh, Colligan, Dungarvan, Co. Waterford	84
P. Flannery, Sheane, Nenagh, Co. Tipperary	70
M. Doyle, Kilbride, Co. Wicklow	42

Black Tartary—Continued.

	Sts.
J. Kenny, Collinstown, Co. Kildare	56
J. S. Driscoll, Aughadown, Skibbereen, Co. Cork	16
J. S. O'Driscoll, Lisheen, Aughadown, Skibbereen	16
Mrs. Hore, Coldblow, Rosslare, Co. Wexford	14
T. Shannon, Newbawn, Co. Wexford	14
T. Codd, Gleneal y, Co. Wicklow	14
Total	1,366
	= 97 Brls. 8 Sts.

Victory II.

	Sts.
J. Carroll, Cartown, Drogheda	56
Mrs. E. Murphy, Johnstown, Dundalk	28
N. Healy, Cree, Co. Clare	28
D. Coughlan, Breeda House, Killeagh, Co. Cork	21
Mrs. Morrissey, Ballynookera, Rostellan, Co. Cork	28
Wm. McAuliffe, Carrigatoher, Midleton, Co. Cork	21
R. Nolan, Clara, Co. Kilkenny	56
James St. John, Cramps Castle, Fethard, Co. Tipperary	70
J. Murphy, Redcow, Dundalk, Co. Louth	42
P. Brady, Cornaslieve, Co. Cavan	21
P. Brady, Drumderg, Co. Cavan	28
L. Brady, Drumderg, Co. Cavan	42
J. McCaffrey, Bawnboy, Co. Cavan	14
J. Glazier, Lixnaw, Co. Kerry	70
E. Mitchell, Ballina, Maryboro', Laoighis	70
J. Spain, Rapla, Nenagh, Co. Tipperary	98
J. Hegarty, Liscahane, Millstreet, Co. Cork	42
J. O'Donoghue, Kilbrin, Kanturk, Co. Cork	28
A. Strahan, Morne, Ballytore, Athy, Co. Kildare	56
T. Kearney, Farranfore, Ballybrack, Co. Kerry	28
G. Foley, Auglout, Killorglin, Co. Kerry	28
J. McS. McCulloch, Gerrardstown, Co. Dublin	56
M. O'Donnell, Araglen, Kilworth, Co. Cork	28
M. Murphy, St. Mullins, Co. Carlow	28
J. Gallaher, Belleighan, Co. Donegal	28
M. Hayden, Marley, Borris, Co. Carlow	28
D. Buckley, Ring, Clonakilty, Co. Cork	16
T. Appleby, Corriganaer, Skibbereen, Co. Cork	16
M. F. Scully, Ardfield, Clonakilty, Co. Cork	16
P. O'Connell, Killumney House, Ovens, Co. Cork	28
E. Hopkins, Kilmainham, Kells, Co. Meath	28
A. Connelly, Creewood, Slane, Co. Meath	28
T. Fox, Cootehill, Co. Cavan	14
Total,	1,189
	= 84 Brls. 13 Sts.

Victory.	Sts.
M. Donnely, Rahara, Roscommon	28
P. McDonnell, Four Roads, Roscommon	28
T. McKeon, Grange, Athlone	28
Mrs. Devereux, Boley, Co. Wexford	14
M. Morduant, Gorey, Co. Wexford	14
E. Moran, Grangemore, Roscommon	14
P. J. Colgan, Rockingham Arms Hotel, Roscommon	14
J. Kennedy, Tinahely, Co. Wicklow	28
A. Connell, Avoca, Co. Wicklow	14
B. Moran, Curradrisk, Castlebar, Co. Mayo	28
P. Moran, Parke, Castlebar, Co. Mayo	42
The Agricultural Station, Ballyhaise, Co. Cavan	70
Capt. Whitehead, Birr Maltings, Birr, Offaly	112
M. Brennan, Crosspatrick, Co. Kilkenny	42
J. Finnegan, Carrickmacross, Co. Monaghan	28
A. Boyle, Mountcormac, Ballina, Co. Mayo	28
J. Munnelly, Crossmolina, Ballina, Co. Mayo	28
P. O'Reilly, Cowneen, Co. Cavan	28
T. Dolan, Bawnboy, Co. Cavan	14
C. Parkes, Ardcotton, Co. Sligo	14
P. O'Brien, Ballykilmurry, Tullamore, Offaly	98
J. Turley, Ballinasloe, Co. Galway	42
Messrs. Kelliher and Sons, Tralee, Co. Kerry	140
J. W. Fahy, Mount Ruby, Mallow, Co. Cork	70
G. C. Kelly, Clair in Bridge, Galway	42
J. Maguire, Esker, Killoe, Co. Longford	14
T. Lennon, Drumlesh, Co. Longford	14
T. Slaney, Johnstown, Bridge, Co. Leitrim	14
J. H. Bennett, Ltd., Ballinacurra, Co. Cork	154
N. Callan, Shanlis, Ardee, Co. Kilkenny	28
J. Holland, Reisk, Co. Kilkenny	14
Total,	1,246
	= 89 Brls.

Victory Mogul 12/2/1.	Sts.
N. Cosgrave, Bree, Enniscorthy, Co. Wexford	14
W. Smith, Dromoland, Newmarket-on-Fergus, Co. Clare	42
R. McHugh, Clondarrig, Portlaoighis, Leix	14
Mrs. M. E. Boland, Blandfort, Abbeyleix, Leix	42
Total,	112
	= 8 Brls.

Glasnevin Sonas.	Sts.
Mrs. Brennan, Drummond, Carlow, Co. Carlow	28
T. Halligan, Bridge Street, Tullow, Co. Carlow	28
P. Brady, Cornaslieve, Virginia, Co. Cavan	7
T. Foy, Lisboduff, Cootehill, Co. Cavan	7
J. Greene, Kilbaha, Co. Clare	14
P. Normoyle, Drumline, Bunratty, Co. Clare	28
R. Woodburn, Broadstrand, Courtmacsherry, Co. Cork	14
W. Bultimer, Cahir, Ballineen, Co. Cork	14
G. Chinnery, Castletown, Enniskeen, Co. Cork	14
J. J. Hosford, Kernagaragh, Bandon, Co. Cork	14
W. Hosford, Castletown, Enniskeen, Co. Cork	14
Richard Shanley, Carhue, Bandon, Co. Cork	14
H. Bateman, Carhue, Bandon, Co. Cork	14
Fred Shorten, Scrahane, Enniskeen, Co. Cork	14
Pierce Shorten, Killinear, Enniskeen, Co. Cork	14
W. H. Bryan, Maryville, Enniskeen, Co. Cork	14
J. O'Sullivan, Innishennon, Co. Cork	14
C. O'Sullivan, Drumkeen, Bandon, Co. Cork	14
T. Cogan, Ballyvodane, Donoughmore, Co. Cork	14
R. J. Buttimer, Cappa, Bandon, Co. Cork	14
J. J. O'Donoghue, Kilbrin, Kanturk, Co. Cork	14
W. O'Callaghan, Scarragh, Lombardstown, Co. Cork	42
R. Philpott, Riverview, Kanturk, Co. Cork	28
P. Howard, Springrove, Kanturk, Co. Cork	14
J. O'Neill, Skeheen, Mitchelstown, Co. Cork	28
M. Flynn, Galtee View, Carrigane, Co. Cork	14
J. O'Donoghue, Gurteenabout, Mitchelstown, Co. Cork	14
W. Bird, Ballydulea, Cobh, Co. Cork	56
J. McS. McCulloch, Gerrardstown, Ballyboghill, Co. Dublin ...	70
M. Maher, Poppintry, Finglas, Co. Dublin	56
T. Fitzgerald, Aulane, Abbeydorney, Co. Kerry	56
Major Phelps, Estate Office, Muckross, Killarney, Co. Kerry ...	28
R. B. Reynolds, Faha Court, Beaufort, Co. Kerry	28
P. Murphy, Bridestream, Kilcock, Co. Kildare	98
A. L. Speirs, Burtown, Athy, Co. Kildare	140
J. J. Kehoe, Crockett House, Mageney, Co. Kildare	42
Col. Harrison, Johnstown, Naas, Co. Kildare	14
T. Brennan, Balleen, Freshford, Co. Kilkenny	70
J. Hayes, Jenkinstown Park, Kilkenny	70
D. J. Gorey, T.D., Burnchurch House, Kilkenny	70
E. Mitchell, Ballina, Portlaoghaise, Laoighis	28
L. Brady, Ballycarney, Portlaoighise, Laoighis	28
T. Kelly, Drumdilure, Gurteen P.O., Manorhamilton, Co. Leitrim ...	14
F. McGuinness, Cankell, Drumsna, Co. Leitrim	14
J. Shanley, Dromard, Dromod, Co. Leitrim	14
L. M. Harris, Ballingaddy, Kilmallock, Co. Limerick	42

Glasnevin Songs—continued. Sts.

D. R. Daly, Kilfrush, Knocklong, Co. Limerick	28
T. F. Russell, Glenview, Ballyneety, Co. Limerick	28
P. C. Burke, Coolelough, Hospital, Co. Limerick	42
T. Weir, Rathowen, Edgeworthstown, Co. Longford	14
P. Feeney, Gurteen, Ballymahon, Co. Longford	14
The Convent, Ardagh, Co. Longford	14
Thos. Gearty, Keenagh, Co. Longford	14
T. Farrell, Cartongeeragh, Longford	14
J. Murphy, Red Cow, Dundalk, Co. Louth	56
N. Callan, Shanlis, Ardee, Co. Louth	28
A. J. Kieran, Dowdstown, Ardee, Co. Louth	70
Senator J. E. McEllin, Brize, Claremorris, Co. Mayo	28
P. Lowther, Rathglass, Ballina, Co. Mayo	14
T. O'Boyle, Dunfeeney, Ballycastle, Co. Mayo	14
W. Quigley, Lessduogue, Knockmore, Co. Mayo	14
Monica Duff and Co., Ballaghadereen, Co. Mayo	70
G. E. Moore, Frayne, Athboy, Co. Meath	14
T. Toole, Crickstown Cottage, Ashbourne, Co. Meath	56
D. Kenny, Warrenstown, Drumree, Co. Meath	14
The Rector, Salesian College, Warrenstown, Drumree, Co. Meath ...	42
W. Flanagan, Killyon, Hill of Down, Co. Meath	14
P. O'Neill, Danestown, Balrath, Navan, Co. Meath	70
F. Walsh, Rathmaiden, Slane, Co. Meath	70
P. Conaty, Ballyhest, Kells, Co. Meath	28
J. Phelan, Boltown Hall, Kells, Co. Meath	28
T. Graham, The Billis, Glasslough, Co. Monaghan	56
P. J. Corry, T.D., Kilcavan, Geashill, Offaly	14
D. Sheil, Rathmore, Edenderry, Offaly	28
G. Thompson, Willsgrove, Ballintubber, Castlerea, Co. Roscommon	42
A. Lawlor, Tibarney, Athleague, Roscommon	14
J. Murray, Crubyhill, Roscommon	14
P. McGreevy, Tiranagh, Boyle, Co. Roscommon	14
P. Shannon, Aughaderry, Loughglynn, Co. Roscommon	14
The Manager, Convent Farm, Loughglynn, Co. Roscommon ...	14
P. J. Colgan, Rockingham Arms Hotel, Boyle, Co. Roscommon ...	28
M. Fallon, Ballyfree, Sligo, Co. Sligo	14
P. McSherry, Mental Hospital, Sligo	14
E. Chambers, Mullinabreena, Chaffpoole, Ballymote, Co. Sligo ...	14
W. Meagher, Templetuohy, Templemore, Co. Tipperary	140
V. Corcoran, Honeymount, Dunkerrin, Roscrea, Co. Tipperary ...	56
J. Ryan, Bridge House, Borrisoleigh, Co. Tipperary	56
J. Mason, Gormanstown, Ardfinan, Cahir, Co. Tipperary	70
R. English, Monaloughra-Burncourt, Cahir, Co. Tipperary ...	56
F. Devane, Tournacurra, Ballymacarty, Clonmel, Co. Tipperary ...	28
P. Egan, Ballygeggan, Dungarvan, Co. Waterford	28
J. Curran, Catherinestown, Mullingar, Westmeath	14

Glasnevin Sonas—continued.	Sts.
J. Maylinn, Mullachloe, Ballymore, Moate, Co. Westmeath ...	28
T. O'Keeffe, Raharney, Killucan, Co. Westmeath	14
C. J. Irwin, Kilcannon House, Enniscorthy, Co. Wexford	28
J .Ryan, Lower Clonmines, Wellington Bridge, Co. Wexford ...	14
T. Shannon, Newbawn, Ballycullane, Co. Wexford	70
W. Adam, Dunbur, Wicklow	42
C. V. Rushell, Templerainey, Arklow, Co. Wicklow	70
Total,	31,192
	= 228 Brls.

WHEAT.

Red Stettin.

As in previous years the Department obtained a pure line stock of this variety from the Albert Agricultural College, Glasnevin, and this was grown on a propagation plot of about 7 statute acres on the farm of Mr. Wm. Prendergast, Derrygrath, Cahir, County Tipperary. Owing, however, to the unfavourable weather at harvest, the produce of this plot was found to be unsuitable for seed purposes.

The produce of the plot of this variety which was grown in the previous year (1929) in the neighbourhood of Clonmel was distributed for County Extension plots as follows:—

	Stones.
A. J. Walsh, Kilmurray, Cordal, Castleisland, Co. Kerry	20
M. Loughlin, Glenearahan, Cordal, Castleisland, Co. Kerry ...	16
T. Hickey, Rathmore, Co. Kerry	16
D. Thornton, Clashmealcor, Causeway, Co. Kerry	16
A. Reynolds, Faha, Beaufort, Co. Kerry	20
M. J. Walsh, Lahirn, Doneraile, Co. Cork	40
F. Applebe, Carriganair, Skibbereen, Co. Cork	15
M. Barry, Skibbereen, Co. Cork	30
T. O'Driscoll, Derrymileen, Enniskeane, Co. Cork	15
D. Brickly, South Ring, Clonakilty, Co. Cork	15
J. Kingston, Templebryan, Clonakilty, Co. Cork	15
J. O'Donoghue, Kilbrin, Kanturk, Co. Cork	20
T. Kelliher, Shanakiel, Kilcorney, Co. Cork	20
F. Burton, Curra, Kanturk, Co. Cork	20
D. Hegarty, Mount Oval Farm, Douglas, Co. Cork	32
S. Ellis, Clogheenmilcon, Blarney, Co. Cork	96
P. McGrath, Ballymow, Waterfall, Co. Cork	40
J. Deasy, Dromdough, Ballinspittal, Co. Cork	14
R. Doyle, Burgess, Killeigh, Co. Cork	48
W. Kenifick, Ardarostig Viaduct, Cork	56

Red Stettin—continued.	Stones.
J. Mathers, Rathcash, Clifden, Co. Kilkenny	60
M. Hurley, Bamford, Co. Kilkenny	50
J. Brophy, Shankill Cottage, Whitehall, Co. Kilkenny	60
H. Horan, Knockshegowna, Shinrone, Co. Tipperary	154
M. Heagney, Fortmoy House, Borrisokane, Co. Tipperary ...	33
W. Lonergan, Whitelands, New Inn, Cahir, Co. Tipperary ...	30
P. O'Connor, Nicholastown, Cahir, Co. Tipperary	80
Total,	1,031
	= 51.5 Brls.

FLAX.

1. Propagations.

(*a*) Single Plant Selections.

In the previous year (1929) many of the pure line selections were infected with Browning disease and only those which showed signs of resistance were retained for further propagation. The following selections were cultivated in 1930:—

Department's pure line No. 6 x White Flowering 10/1
,, ,, ,, 10/2
,, ,, ,, 10/3
J.W.S. No. 21.
A Selection from Commercial Riga Seed.
A Selection from Commercial Dutch Seed.

(*b*) Garden Plots:—

Department's pure line No. 6.
Danish pedigree No. 21.

With the object of controlling Browning disease (Polyspora lini) the seed sown on these plots was treated with Ceresan. Nevertheless, a considerable amount of the disease developed in both plots.

2. Experiments.

(*a*) Control of Browning disease (Polyspora lini).

This experiment was conducted on somewhat similar lines to the trials carried out in the previous season. Particulars of the various treatments compared, the size and arrangement of the plots, date of seeding, etc., are set out in Table VI.

The seed treated with copper carbonate and mercuric chloride and sown on Plot 3 germinated very badly. It was evident that the treatment had affected the germination and on inspection later in the season it was noticed that the plants which did grow on this plot were badly infected with disease. All the treated plots had less disease than the control plots, but none of

them was free from the disease. The plot sown with seed treated with Granosan was least affected, and that treated with Ceresan was the next best in this respect. The flax on all plots lodged so that it was found impossible to secure weighings of the produce.

TABLE VI.

Variety of seed grown ... Department's Pure Line No. 6.
Area of each plot ... 1 sq. perch.
Seed sown per plot ... 10 ozs. (285 grams).
Date of sowing ... ... 15th April.

Plot.	Disinfectant.	Rate.	Method.	Sown.
1	Abavit ...	5 : 1000 (1·43 gr.)	All disinfectants	April 15th.
2	Control ...	—	applied dry	,,
3	Cu Co3+Hg Cl2	5 : 1000 (1·43 gr.)	shaken for 5	,,
4	Ceresan ...	5 : 1000 (1·43 gr.)	minutes.	,,
5	Control ...	—		,,
6	Granosan ...	5 : 1000 (1·43 gr.)		,,

(*b*) Variety Trials.

Trials with five varieties were conducted at five centres in the principal flax growing areas. Particulars as to the varieties sown and the yields obtained at each centre are shown in Table VII.

TABLE VII.

YIELDS PER STATUTE ACRE-SCUTCHED FLAX.

Centre.	Danish Pedigree No. 21.		Department's Pure Line No. 6.		Riga.		"J. W. S."		Dutch.	
	St.	Lbs.	St.	Lbs.	St.	Lbs.	St.	Lbs.	St.	Lbs.
1	47	2	39	4	36	6	40	–	42	12
2	31	6	27	12	22	2	30	–	15	10
3	44	4	36	6	43	8	32	2	33	8
4	25	–	31	11	36	1	26	1	31	6
5	50	–	52	12	40	10	45	–	38	8
Average Yield.	39	8	37	9	35	11	34	9	32	6

Danish Pedigree 21 which has consistently given good returns in these trials produced the highest yield.

SAORSTÁT ÉIREANN MID-SEASON FRUIT CROP REPORT, 1931.

The present season is, what may be termed, a lean one for fruit growers, more particularly for the growers of apples and pears. The chief causes which have contributed to this condition are:—(1) The abnormally heavy crop of fruit of all kinds produced last Season. (2) The cold, wet and sun-less weather of last Autumn which prevented trees and bushes forming good strong fruit buds, and (3) the severe weather conditions prevailing during the early Spring months of this year at flowering time mitigating against fertilisation of the blossoms by bees and other insects.

The weather conditions also delayed the flowering and fruit formation of the bush fruits, with the result that the crops were up to a fortnight later in ripening than usual.

Extremely cold and wet weather was experienced in Counties Wexford, Westmeath, Cavan and Limerick, while in Co. Laoighis it was reported as being the coldest and wettest Spring experienced in that district for 60 years. In Counties Meath, Monaghan, Wicklow, Kildare, Clare and Carlow hail storms did a great deal of damage to various kinds of fruits at setting time. In County Kerry fruit growers were more fortunate as the weather in that district was more favourable during the early months, but later severe frost at night caused many of the flowers to drop off with consequent reduction in the crop.

The following particulars regarding the fruit crop have been obtained from reports kindly supplied by growers in the different Counties of Saorstat Eireann, supplemented by reports obtained from the Horticultural Instructors in each County.

Bush and Small Fruits.

Gooseberries:—This year's crop, although later than usual turned out to be good in almost every County in the Saorstat—at only eleven out of the one-hundred-and-sixty centres from which reports were received were the yields stated to be below average. The berries were at first slow in swelling but later developed to a good sized fruit. The crop was reported as exceptionally heavy and of a good quality in Counties Carlow, Cavan, Kerry, Wexford and Longford, but was only an average one in County Mayo. The varieties reported to have borne the heaviest crops are "Whinhams Industry," "Keepsake" and "Early Sulphur," In County Dublin the variety "Careless" produced a heavy crop of large berries. In County Sligo the crop was very irregular, being heavy in some districts and light in others, but on the whole it was reported as being below average. Prices on the whole were fair and averaged about 1s. 4d. per gallon. In County Donegal however, prices were as low as 1s. per stone, while in Dublin they realised as much as 2½d. to 5d. per lb.

Strawberries.—Strawberries came into flower about a fortnight later than usual and thus escaped a good deal of the damage from frost. The flowers set well, but owing to the continuous rain and low temperatures the fruit

grew slowly and except in moderately dry and exposed situations it was poor in colour and deficient in flavour. This was the case particularly with the variety "Mad Kooi." Owing to the continued humid atmosphere many of the fruits damped off and did not mature. In County Dublin where large quantities of "Laxton" and "Royal Sovereign" are grown for the market, the yield was about average, but owing, to the fact that the fruit was gathered under very bad weather conditions it was soft and pulpy. In County Louth the variety "Leader" produced heavy crops of good fruit. Prices ranged from 10d. to 1s. 8d. per lb. on the average. In County Meath the price was from 8d. to 1s. per lb. In County Dublin good strawberries sold at as high as 2s. 8d. per lb. while at the same centre inferior fruit fetched only 6d. per lb.

Raspberries.—In general these have produced an average or over average crop of fruit in spite of the fact that many of the canes died back at the flowering period. Many correspondents stated that their plants had a sickly appearance when flowering, and the crop suffered as a result. Where the fruit had to be gathered in wet weather and sent long distances to market it suffered considerable loss and depreciated very much in value. The flavour of the fruit in general was not up to the usual standard. The "Lloyd George" variety bore the heaviest and the best crops. In County Dublin raspberries fatched from 6d. to 1s. per lb. In County Cork jam manufacturers offered 23s. 6d. to 28s. per cwt. In Galway foreign supplies killed the local trade and the best home grown realised only 5d. to 6d. per lb. In County Sligo the fruit sold at 6d. per lb.

Loganberries.—This year heavy crops are reported from almost every district and in County Wexford the crop was reported as offering to be the heaviest since 1913. The wet and cool weather was favourable to the swelling of the fruit, and it is in general a very good crop in size and quality.

Red and White Currants.—These plants produced a good crop of fruit of very good size and quality. Only about seven per cent of the reports were of an adverse character, and exceptionally good crops were gathered in Counties Cavan, Limerick, Meath and Westmeath. In Counties Mayo and Tipperary the fruits were below average in size and ripened un-evenly.

Black Currants are reported generally to be a very good crop. The fruits, though swelling slowly and ripening later than usual, developed well and produced some of the finest fruits we have had for many years. They were particularly good in Counties Clare, Limerick, Westmeath, Monaghan and Galway where the most successful varieties were "Boskoop Giant" and "Baldwin." In County Kildare the crop was moderate and patchy and very late in ripening, while in County Roscommon the crop was heavy, but was inferior in size and quality. Prices realised for home grown fruit averaged from 4d. to 8d. per lb. Foreign supplies tended to reduce the price of home grown black currants in Galway and Dublin.

Apples :—This year's crop promises to be one of the worst recorded for a number of years, and this is specially apparent in those orchards where the trees bore abnormally heavy crops last year. Of the one-hundred-and-sixty returns received only fifteen report a good or very good crop, while

one-hundred-and-five report that the yield is either under average or bad. It is only those trees which have been well manured, well pruned and properly sprayed, that show signs of producing an average crop. Fairly good crops are reported from Counties Clare and Donegal. Where the trees were sprayed with the tar-oil sprays in winter and later with the lime and copper sulphate spray they have a healthy appearance. The fruit in such cases is not so seriously affected with spot or apple-scab, and little damage has been done by insect bites. In County Kildare the crop is irregular, but it is, on the whole, up to the average. In County Kerry the early varieties "Beauty of Bath," "Worcester Pearmain" and "Charles Ross" are bearing fair crops, but on the later varieties—"Bramley's Seeding" "Newtown Wonder," and "Lane's Prince Albert" the yield of fruit is expected to be poor. In County Dublin "Irish Peach," "Beauty of Bath" and "Bramley's Seeding" are bearing well, but "Allington Pippin" and "Newtown Wonder" have light crops. In County Mayo the crop is poor in general and, though the trees blossomed well, they were much injured by strong western gales during the Spring when the fruit was setting. There are prospects of an average crop in Counties Westmeath, Offaly and Longford. The two varieties which appear to be bearing good crops are "Beauty of Bath" and "Bramley's Seeding."

Pears.—The prospects of the pear crop are very poor all over the country —only about seven per cent of the returns report a good crop. While over seventy per cent report the crop as under average or bad, it is only on trees grown against walls or on trees which are very well sheltered that an average crop is to be found. This is due to the storms of hail and cold rain which were experienced when the trees were in flower. Pears flower early in the season and for this reason it is seldom that good crops are obtainable in the Northern Counties of Saorstat Eireann because of the colder climate conditions prevailing there. The varieties bearing fairly well are "Durondeau," "Pitmaston Duchess," "Williams' Bon Chretien" and "Doyenne du Comice."

Plums.—These may be regarded as an average crop. In Counties Meath, Tipperary, Carlow and Waterford the "Czar" variety is bearing very good crops. The "Victoria" and "Horse Plum" varieties are reported as carrying good crops, in Counties Cork, Clare, Longford, Wicklow and Meath. In the same Counties "White Transparent" and "Green Gages" are bearing poor crops. County Wexford reports a good general set of fruit, but many dropped owing to the incessant rain amd low temperature after setting, and the crop now appears as about average.

Damsons :—Except in Counties Donegal and Cavan, where the crop is good, and in Counties Meath and Louth where it is reported as fair, the yield of damson crop is expected to be very poor. Last year's exceptionally heavy crop in Monaghan partly accounts for the very poor one which is being produced there this year.

Cherries were an average or slightly below average crop in general. In Counties Donegal and Dublin the crop was good, while in Counties Galway and Wicklow the crop was described as light. In County Kerry the "White Heart" and "Napoleon" varieties yielded well, but the variety "Black Heart" was poor, In most cases the "Morello" variety carried an average

yield, but the sweet varieties were on the light side. In County Wicklow cherries made 1s. per lb., in Waterford 9d. and in County Dublin the price ranged from 8d. to 1s. 6d. per lb. according to quality.

Other Fruits.

Peaches and Figs are turning out better than was expected, considering the bad weather experienced in Spring. In Counties Limerick, Cork, Waterford, and Tipperary the crops are about average, but in the Northern part of the country they are only fair, owing to cold climate, and bad weather conditions.

Insects, Fungoid Pests, etc.

Since the spraying of trees in winter with the tar-oil sprays has become general, much less damage has been done to fruit trees by insect pests ; but on account of the fact that many of the insects which attack fruit trees and bushes also attack other trees, there is great difficulty in exterminating all the pests. Up to the present very little damage has been done by wasps, as the cold Spring mitigated against their propagation. Winter moth caterpillars, on apple trees, and gooseberry sawfly catterpillars did some damage but not by any means to such an extent as in former years. Caterpillars of ermine and lackey moths did a great deal of damage in Counties Wicklow, Waterford and Galway, even extending their ravages to bushes growing in the hedge-rows, and entirely de-foliating some of the bushes. All over the country returns show that slugs and snails caused much damage to strawberries and very much reduced the value of the crop. They have been the most troublesome pests this year. In County Kildare blue tits and bullfinches did much damage to fruit buds early in the year, and in Counties Cork and Kildare wood pigeons have given considerable trouble.

Of the fungoid diseases the most destructive this Season has been the cluster cup on gooseberries. Except in low-lying situations and where proper spraying has not been carried out the apples and pear scab have not been so serious as in past years. Apple mildew is reported to be prevalent especially on old trees in Counties Kerry, Louth, Dublin and Wexford. Silver leaf is reported to have done much damage to plums in Counties Dublin, Meath, Limerick and Wicklow, and to apples in County Kildare. As in previous years, apple canker is very prevalent especially on trees growing on un-drained soils.

FIELD EXPERIMENTS, 1930.

The following report deals with Field Experiments conducted in 1930. These experiments comprised trials with varieties of crops, experiments with nitro-chalk and other nitrogenous manures on root crops, tests with Clare phosphate and other phosphatic manures on peaty soils, and manurial trials on grasslands.

The detailed returns in respect of each test conducted by Agricultural Instructors may be found in the Annual Reports issued by the County Committees of Agriculture, and farmers and others interested are recommended to apply for a copy of the report to the Agricultural Instructor or to the Secretary of the County Committee for the County.

EXPERIMENTS WITH VARIETIES OF CROPS.

Wheat.

Trials with Autumn or Winter sown varieties of wheat were conducted by Agricultural Instructors in each County except one in the Sáorstát during the season 1929-30. The following five varieties were included in the trials at all centres:—Queen Wilhelmina, Yeoman II, Red Stettin, Coney Island (short straw) and Iron Master. All these varieties with the exception of Iron Master had been included in the tests conducted during the three previous seasons. Iron Master is a new variety of wheat raised at the Albert Agricultural College, Glasnevin. It is the produce of a cross between the varieties, Iron and Square Head Master, and is a red wheat with a strong straw of medium length, a dense, heavy ear, and a large, plump grain. It is a slow grower during the winter, and a late ripener, and on account of the large size of the grain it requires to be sown at a heavier rate than most other varieties.

At two of the centres at which the trials were conducted, principally owing to adverse weather conditions at the time of sowing, the seed of all five varieties germinated poorly, and the resulting braird was so thin and patchy that it was considered advisable to have the ground ploughed up during the spring and a root crop sown instead. Iron Master and Yeoman II also failed at three other centres, and Coney Island and Red Stettin at four other centres. From six centres it was reported that Queen Wilhelmina ripened a few days before the other varieties. At four centres Coney Island and Yeoman II were ripe first, and at one centre Red Stettin was fit to harvest a few days earlier than any of the other varieties. Iron Master, although harvested in the great majority of cases at the same time as the other varieties, was in no instance reported as being ripe first.

At two centres the crops on all the plots lodged and tangled so badly at harvest-time that it was impossible to obtain reliable results. Iron Master and Coney Island resisted lodging better than Yeoman II or Queen Wilhelmina. Red Stettin lodged badly at about a third of the centres and to a lesser degree at approximately half of the remaining centres, and it was only in four or five cases that it was found possible to harvest this variety with the reaper and binder.

Detailed returns were obtained from 25 centres, and these are set out in Table I.

TABLE I.

COUNTY.	Character of Soil.	Date of Sowing.	Yeoman II.		Queen Wilhelmina.		Red Stettin 13		Coney Island (Short Straw)		Iron Master.	
			Grain C. Q.	Straw C. Q.	Grain C. Q.	Straw C. Q.	Grain C. Q.	Straw C. Q.	Grain C. Q.	Straw C. Q.	Grain C. Q.	Straw C. Q.
Clare	Medium Loam	5/2/30	19 3	38 1	26 0	42 1	17 1	43 1	20 1	46 3	15 1	29 0
Cork ...	Sandstone loam	9/11129	14 3	26 1	17 0	22 2	13 1	28 3	17 2	25 3	22 2	25 3
Cork, N.W.	Rich deep loam	—	27 2	42 1	26 1	46 3	21 1	47 2	25 0	36 1	26 2	39 0
Dublin	Stiff Clay loam	28/3/30	11 0	22 3	18 2	25 2	16 2	30 1	12 1	21 3	12 3	19 3
,,	Rich clay loam	22/9/29	22 1	51 0	38 0	75 3	27 2	54 1	36 2	61 2	34 2	51 1
Galway	Loam (limestone).	24/1/30	15 3	27 0	17 1	31 0	18 2	34 0	16 0	28 0	17 1	32 0
Kerry	Light loam ...	31/10/30	15 0	30 0	21 1	34 0	15 0	36 0	17 2	32 0	17 2	32 0
,,	Medium loam	—	23 2	—	20 1	—	23 1	—	15 3	—	18 1	—
Kildare	Clay loam ...	14/11/29	22 0	50 1	22 2	60 1	5 3	48 0	21 1	54 3	21 2	62 2
Kilkenny	Medium loam	26/10/29	22 3	31 2	25 1	34 2	12 3	27 2	22 1	30 2	23 3	33 1
Laoighis	Light loam ...	21/10/29	20 0	28 1	25 0	34 1	19 3	35 3	23 3	29 3	29 3	37 3
Limerick, E.	Clay loam ...	26/3/30	20 0	48 0	20 0	62 0	20 0	48 0	18 0	52 0	15 0	42 0
Longford	—	—	22 1	40 1	30 0	42 3	22 0	38 1	23 0	38 0	18 2	34 2
Mayo	Medium loam	3/12/29	20 3	38 2	21 0	39 0	18 2	37 0	18 0	35 3	22 0	39 0
Meath	Heavy clay loam	7/11/29	37 2	45 1	36 2	45 3	31 0	46 1	33 2	42 2	39 0	47 2
Monaghan	Loam ...	—/12/29	12 0	36 3	19 2	38 0	18 0	36 3	13 3	36 2	11 0	35 0
Roscommon	Clay loam ...	5/11/29	32 3	—	24 2	—	27 2	—	20 2	—	28 1	—
,, Nth.	Medium loam	5/11/29	20 2	32 2	25 0	37 2	20 1	26 2	22 2	28 1	25 3	36 2
Sligo ...	Medium loam	—/11/29	16 2	22 2	30 0	45 0	19 3	34 0	21 1	36 2	14 1	19 0
Tipperary, N.R.	Strong cold clay	27/2/30	24 1	30 1	28 3	34 0	22 2	36 0	25 2	34 0	34 1	25 0
,,	Clay loam ...	27/2/30	33 2	33 2	30 1	36 2	30 0	38 1	24 0	29 0	29 0	29 2
Waterford	Sandy loam ...	—/2/30	20 0	37 3	26 1	39 1	18 1	44 0	22 1	38 1	17 3	26 3
Wexford	Clay loam ...	25/10/29	15 0	30 2	23 0	40 0	20 1	32 0	16 2	30 0	20 1	28 0
Wicklow	Strong loam ...	10/2/30	16 0	28 0	25 0	35 0	23 1	34 0	19 2	27 0	16 2	30 0
,,	Medium loam	31/10/29	10 2	25 0	16 1	30 0	11 2	28 0	17 2	26 0	16 0	26 0
Average yield per Statute Acre, (grain 25 centres, straw 23 centres) ...			20 3	34 2	24 2	40 2	19 3	38 0	21 0	35 3	22 3	34 0

As in the previous trials, Queen Wilhelmina produced the heaviest average yield of grain, and of the other varieties included in the trials Iron Master gave the greatest return. Red Stettin produced the smallest yield, and as this variety appears to be incapable of resisting lodging in a bad season it cannot be recommended for general cultivation. The quality of the grain produced by all four varieties was, probably owing to the bad harvest weather, not of a very high standard.

Oats.

Trials with three varieties of white oats, Victory II, Glasnevin Sonas, and Victory Mogul, were conducted by Agricultural Instructors at 34 centres in 24 counties during the season of 1930. As in the similar trials conducted in previous years, the seed of each variety tested was drawn from the produce of pure line selections. The seed of Glasnevin Sonas and Victory Mogul was obtained from the Albert Agricultural College, Glasnevin, and that of Victory II from the Department's Cereal Station at Ballinacurra, County Cork.

The heavy rains and stormy weather conditions which prevailed during the latter half of July and throughout the month of August provided an excellent test of the standing qualities of the straw of the different varieties, and in this respect Glasnevin Sonas proved greatly superior to the other two varieties. Victory Mogul lodged badly at 14 centres, Victory II at 8 centres, and Glasnevin Sonas at only one of the 34 centres at which the trials were carried out.

Victory II was in most cases fit to harvest a few days in advance of Victory Mogul, and the latter variety a few days earlier than Glasnevin Sonas. At six centres it was found impossible to secure accurate weighings owing to the lodged and tangled condition of one or more varieties. Detailed results were obtained from 24 centres, and these are set out in Table II. Although Glasnevin Sonas stood up well and produced on the average the highest yield, the other two varieties, which gave practically similar returns, produced grain which at most centres was superior in colour, plumpness and general appearance to that of Glasnevin Sonas.

[Table.

TABLE II.

County.	Character of Soil.	Yields per Statute Acre.											
		Victory II.				Glasnevin Sonas.				Victory Mogul.			
		Grain.		Straw.		Grain.		Straw.		Grain.		Straw.	
		C.	Q.	C.	Q.	C.	Q.	C.	Q.	C.	Q.	C.	Q.
Carlow	Light limestone gravel.	18	1	33	0	18	3	28	2	18	2	31	2
Clare	Medium loam ...	32	1	52	2	33	0	51	1	30	1	48	1
,, ...	,, ,,	18	2	33	0	18	2	31	1	18	0	35	3
Cork	,, ,, ...	26	3	34	0	26	0	39	0	25	3	28	3
,, S.E.	Sandy loam ...	26	2	49	1	25	1	38	3	26	1	31	3
,, N.E.	Medium loam ...	25	3	46	0	25	3	43	2	23	3	48	2
,, N.W.	Deep clay loam ...	29	3	48	3	31	3	50	1	32	2	54	0
Donegal	Light loam ...	19	2	24	2	20	0	25	2	16	3	24	0
Dublin	Clay loam ...	21	0	25	1	23	1	27	2	18	2	24	3
Galway	Moory (reclaimed bog—rich soil).	18	0	30	0	20	2	28	0	19	1	30	0
Kerry	Peaty	13	3	46	1	14	1	36	3	13	3	45	0
Kildare	Clay loam ...	17	2	32	3	19	3	31	0	18	2	31	2
Kilkenny	Medium loam ...	25	0	31	1	22	1	28	3	24	2	30	0
Laoighis	Peaty loam ...	19	2	31	1	15	2	18	1	19	3	30	2
Leitrim	Heavy peat ...	21	2	36	3	20	0	37	2	20	2	36	0
Limerick, E. ...	Loam	20	0	48	0	23	0	55	0	18	0	42	0
Mayo	Clay loam ...	23	0	39	1	25	2	41	2	21	1	38	3
,, ...	Strong loam ...	22	2	40	0	23	0	40	2	20	0	39	2
Meath	Gravelly loam ...	21	1	38	0	25	2	43	0	20	2	38	3
Offaly	Strong loam ...	17	3	—		17	0	—		19	2	—	
Roscommon ...	Medium clay loam	25	3	—		27	2	—		22	0	—	
,, Nth. ...	Loam	22	2	31	2	24	0	34	2	23	0	34	0
Sligo	Medium loam ...	19	2	29	0	17	1	24	0	18	3	27	0
Tipperary, N.R. ...	Strong clay ...	28	1	43	0	31	0	47	0	27	1	40	0
,, S.R. ...	Medium clay ...	22	2	34	0	28	0	42	2	24	2	38	2
Westmeath	Medium loam ...	19	1	32	1	23	1	33	2	21	3	32	3
Wexford	Loam	23	1	29	0	26	2	27	0	23	2	30	0
Wicklow	Medium loam ...	23	0	35	0	19	2	32	0	21	2	34	0
Average yield per Statute Acre, (grain 28 centres ; straw 26 centres). ...		22	1	36	3	23	0	36	0	21	3	35	2

Supplies of Pure Line Seed.

In connection with the Department's scheme for the distribution of pedigree seed oats amongst farmers, extension plots of the principal varieties have been grown at various centres for a number of years under the supervision of the Department and the Agricultural Instructors, and considerable quantities of seed, particularly of Victory II, Glasnèvin Sonas, and Black Tartary, are now available in most counties. Growers are recommended to ascertain from the Agricultural Instructor for their district where supplies of seed of these and other varieties may be obtained.

Potatoes.

As in previous variety trials conducted by the Agricultural Instructors

since 1927, the "seed" of all varieties included in the experiments during the season 1930 was procured from one centre in County Donegal. Tests with four varieties, Up-to-Date, Kerr's Pink, Arran Consul, and Arran Banner, were conducted at 40 centres in 26 counties. The average returns obtained from all centres, together with the average total yields for the previous season, are shown in Table III.

TABLE III.

Variety	Average yield per statute acre 1930 (40 centres)				Average total yield per statute acre 1929 (40 centres)
	Saleable	Small	Diseased	Total	
	T. c. q.	T. c. q.	T. c. q.	T. c. q.	T. c. q.
Arran Banner ...	16 7 0	1 3 1	0 8 1	17 18 2	17 11 0
" Consul ...	14 10 0	0 19 1	0 4 2	15 13 3	14 6 0
Kerr's Pink ...	13 0 0	1 15 0	0 3 0	14 18 0	15 9 0
Up-to-Date ...	12 7 0	1 10 1	0 9 1	14 6 2	17 6 0

Arran Banner, which was included for the first time in these trials in 1929, and which in that season gave the best return, again produced the heaviest yield of tubers.

Arran Consul, which in the previous trials was found to be inferior in yielding capacity to Kerr's Pink and Up-to-Date, gave a better return than either of these varieties. It was again reported that Arran Consul appeared to be more susceptible to "black leg" disease than any of the other varieties included in the trials.

Root Variety Trials.

As in the previous year, the selection of the varieties which should be included in the tests was left to the Agricultural Instructors. In the trials with mangel varieties, Red Intermediate, Yellow Globe and Lord Warden were included at all centres, and in the Swede variety tests Magnificent and Tipperary. The above-mentioned varieties of both mangels and swedes have consistently produced good yields in similar trials over a considerable period of years. In addition, a number of other varieties of both mangels and swedes, many of which were supplied by Irish seedsmen, were included at practically every centre.

The detailed returns obtained in each trial have already been published in the annual reports issued by the different County Committees of Agriculture.

Grass Seed Mixtures.

During the season of 1926 and again in 1927 experiments were laid down by Agricultural Instructors with the object of determining the relative values for the production of hay and pasture of the mixture including Italian Rye Grass and Meadow Fescue, which has been widely employed for a number of years with satisfactory results, and a mixture from which Italian Rye Grass and Meadow Fescue were excluded, and an additional

quantity of Cocksfoot included instead. The following mixtures were compared:—

No. I.	No. II.
15 lb. Perennial Rye Grass.	15 lb. Perennial Rye Grass.
7 ,, Italian Rye Grass.	3 ,, Timothy.
4 ,, Meadow Fescue.	9 ,, Cocksfoot.
3 ,, Timothy.	2 ,, Broad Red Clover.
3 ,, Cocksfoot.	2 ,, Late Flowering Red Clover.
2 ,, Broad Red Clover.	1 ,, Alsike Clover.
2 ,, Late Flowering Red Clover.	1 ,, White Clover.
1 ,, Alsike Clover.	
1 ,, White Clover.	

Detailed reports on the results obtained from the two series of experiments in the seasons 1927, 1928 and 1929 have already appeared in the Department's Journal, Vol. XXVIII., No. 1; XXVIII., No. 2; and Vol. XXX., No. 1.

For the season of 1930 reports were received from 26 of the 37 centres at which the trials were originally laid down in 1926. At 24 of the centres the plots were grazed, and it was reported that at 15 of these the pasture produced from the mixture containing the relatively large proportion of cocksfoot was earlier, had a thicker and better sole of grasses, and contained a greater proportion of clovers than the pastures produced from the mixture in which Italian rye grass and meadow fescue were included. From two centres it was reported that the mixture containing Italian rye grass and meadow fescue produced the better pasture, and at the remaining seven centres where the plots were grazed there was no noticeable difference in the appearance of the pasture on the different plots. At the two centres where the plots were mown, the No. I mixture gave, on the average, a slightly better yield of hay than the No. II mixture.

Reports from the ten centres where the trial was commenced in 1927 indicate that, in the season of 1930 when all the plots were grazed, there was no noticeable difference in the appearance of the pasture on the different plots except in three cases where the No. II. mixture was said to have produced a better pasture than the No. I mixture.

EXPERIMENTS WITH NITRO-CHALK AND OTHER NITROGENOUS MANURES.

Experiments with nitro-chalk, sulphate of ammonia and nitrate of soda on both the mangel and turnip crops were conducted by Agricultural Instructors during the season 1930 on exactly the same lines as in the previous season. Trials on mangels were laid down at 33 centres, and on swedes at 25 centres. Detailed particulars as to the manures applied and yields obtained in respect of the experiments on mangels and swedes are set out in Tables IV. and V. respectively.

In the trials on swedes similar average yields were obtained from the different nitrogenous manures when applied either in the drill at sowing time or after the crop was singled. In the experiments on mangels practi-

cally similar results were obtained from sulphate of ammonia and nitro-chalk, both applied in the drill at sowing-time. As in the previous season, nitrate of soda in the form of a top-dressing gave slightly better results than nitro-chalk applied in a similar manner.

TABLE IV.

County.	Character of Soil.	Manures applied and Yields obtained per Statute Acre									
		Plot I. 20 tons dung, 4 cwt. super, 4 cwt. Kainit, 298 lb. Nitro-Chalk, applied at time of sowing.		Plot II. 20 tons dung, 4 cwt. super, 4 cwt. Kainit, 2 cwt. Sulphate of ammonia, applied at sowing.		Plot III. 20 tons dung, 4 cwt. super, 4 cwt. Kainit.		Plot IV. 20 tons dung, 4 cwt. super, 4 cwt. Kainit, 298 lb. Nitro-Chalk (Top-Dressing).		Plot V. 20 tons dung, 4 cwt. super, 4 cwt. Kainit, 298 lbs. Nitrate of soda (Top-dressing).	
		T.	C.	T.	C.	T.	C.	T.	C.	T.	C.
Carlow ...	Heavy Soil, clay loam	30	10	39	8	18	12	24	11	22	15
Clare, (W) ...	Medium loam	37	13	36	1	30	8	32	8	38	3
,, ...	Heavy loam ...	34	3	38	11	33	5	36	18	37	3
Cork ...	Light loam over gravel	43	7	40	7	36	0	37	3	38	17
Cork, S.E. ...	Gravelly sandstone loam.	28	17	27	16	19	10	26	14	29	0
Cork, N.W. ...	Medium clay loam.	34	6	34	13	33	11	35	0	36	1
Donegal ...	Deep medium loam.	28	2	30	10	18	0	26	8	24	12
Dublin ...	Loam ...	39	4	40	0	36	13	47	1	46	4
,, ...	Clay loam ...	43	0	42	18	36	8	43	17	44	2
Galway ...	Light limestone loam.	22	6	23	15	17	4	23	12	23	9
,, ...	Medium limestone loam.	24	0	24	10	19	2	24	15	24	12
Kerry ...	Medium loam	34	0	32	10	32	3	32	11	35	11
,, ...	Medium loam	36	0	37	11	33	5	34	11	37	11
Kildare ...	Clay ...	35	18	36	12	27	0	35	10	34	6
Leix ...	Light loam ...	34	17	29	11	25	17	30	14	33	7
Leitrim ...	Peaty loam ...	28	10	30	2	24	6	28	14	28	3
Limerick, E. ...	Limestone loam	37	16	39	0	33	4	36	7	35	12
Limerick ...	Light sandstone loam.	43	4	39	6	25	0	39	6	45	2
Longford ...	Heavy loam ...	42	2	39	16	39	0	46	4	45	1
Mayo ...	Clay loam ...	34	10	34	15	29	12	35	16	35	16
,, ...	Moory loam ...	26	10	28	12	24	12	26	15	28	10
Meath ...	Clay loam ...	42	0	49	19	37	0	43	18	51	8
Monaghan ...	Loam ...	25	15	26	17	22	0	27	6	27	10
Offaly ...	Medium loam	28	5	30	8	25	10	27	16	30	2
Roscommon ...	Medium light clay loam.	24	5	25	9	23	6	28	6	31	4
,, ...	Peat ...	24	10	26	0	20	10	21	8	23	0
Sligo ...	Medium loam	35	14	34	11	27	4	30	0	31	3
Tipperary, N.R.	Strong clay ...	24	6	24	14	19	3	25	3	24	9
Tipperary, S.R.	Medium clay ...	30	5	34	5	28	0	35	8	37	11
Waterford ...	—	39	3	36	19	28	8	34	18	35	13
Westmeath ...	Light gravelly loam.	31	6	32	9	26	16	30	2	28	12
Wexford ...	Sandy loam ...	35	15	39	9	30	0	36	3	40	18
Wicklow ...	Deep loam ...	27	6	28	2	25	10	27	15	28	9
Average yield per statute acre (33 centres) ...		33	0	33	7	27	9	32	7	33	15

TABLE V.

County.	Character of Soil.	Manures Applied and Yields obtained per Statute Acre.									
		PLOT I. 4 cwt. Super, 3 cwt. Kainit, 149 lb. Nitro-Chalk, applied at time of sowing.		PLOT II. 4 cwt. Super, 3 cwt. Kainit, 112 lb. Sulphate of Ammonia, applied at time of sowing.		PLOT III. 4 cwt. Super, 3 cwt. Kainit.		PLOT IV. 4 cwt. Super, 3 cwt. Kainit, 149 lb. Nitro Chalk. (Top-dressing).		PLOT V. 4 cwt. super, 3 cwt. Kainit, 149 lb. Nitrate of soda. (Top dressing).	
		T.	C.	T.	C.	T.	C.	T.	C.	T.	C.
Clare (W.) ...	Medium loam	26	19	27	14	25	13	26	11	26	5
Cork, N.W. ...	Medium loam	21	0	20	11	20	6	22	0	20	14
Donegal ...	Medium loam	24	5	26	10	20	5	23	5	25	10
,, ...	Heavy loam ...	25	0	27	0	21	0	26	10	29	0
Dublin ...	Light loam ...	20	11	20	4	19	7	20	12	21	2
,, ...	Clay loam ...	21	13	21	8	18	4	19	4	19	6
Galway ...	Light limestone loam.	22	15	22	6	20	5	22	3	22	8
,, S. ...	Medium loam	24	0	24	10	19	2	24	15	24	12
Kildare ...	—	21	14	22	6	16	12	22	10	21	15
Laoighis ...	Average loam	15	17	16	14	14	3	14	18	17	11
Leitrim ...	Peaty Soil ...	21	0	22	5	21	0	23	5	23	10
Limerick, E. ...	Limestone loam	30	18	30	6	27	9	28	12	29	3
Longford ...	Medium clay ...	31	11	30	7	30	4	35	0	37	3
Louth ...	Medium clay ...	28	13	27	14	26	13	27	17	30	0
Mayo ...	Clay loam ...	18	6	18	12	16	5	18	5	18	10
,, ...	Medium loam	28	16	28	12	24	17	28	6	28	5
Meath ...	Clay loam ...	27	14	29	4	26	8	28	2	28	17
Monaghan ...	Heavy loam ...	18	6	18	3	11	12	17	16	18	12
Offaly ...	Strong clay ...	15	0	11	12	13	0	15	11	15	3
Tipperary, N.R.	Clay loam ...	21	14	22	3	20	6	20	9	21	12
Tipperary, S.R.	Medium clay	18	0	19	3	16	17	20	0	18	5½
Westmeath ...	Gravelly loam	18	7	21	11	16	14	18	12	17	18
Wexford ...	Sandy loam ...	19	12	19	12	17	9	20	6	18	3
,, ...	Loam ...	18	12	22	12	15	12	18	3	19	9
Wicklow ...	Deep loam ...	19	0	19	2	16	8	19	16	19	4
Average yield per Statute Acre (25 centres) ...		22	10	22	18	19	19	22	10	22	17

TESTS WITH CLARE PHOSPHATE ON PEATY SOILS.

During the past four years trials on swedes, meadow hay, and pasture with Clare phosphate and other phosphatic manures in general use have been conducted at a large number of centres, and reports on the results obtained in each series of trials have already been published in this Journal.* It was found that, in the great majority of cases, the Clare phosphate produced results inferior to those obtained from Superphosphate and North African Mineral Phosphate. At a limited number of centres, however, reasonably good returns were obtained from Clare Phosphate, and

* Department's Journal. Vols. XXVI. No. 4; XXVIII No. 1; XXVIII No. 2; and XXX No. 1.

it was observed that in many instances, particularly on pasture, the most satisfactory results from this phosphate were obtained on acid,* peaty or boggy soils. Consequently, with a view to obtaining further information as to the relative merits of Clare Phosphate and other phosphatic manures when applied to peaty soils, arrangements were made for the conduct of a further series of tests on swedes, meadow hay, and pasture during the season of 1930. The trials, which were conducted by Assistant Agricultural Overseers, were, in all cases, located on reclaimed bogland or on soil of a distinctly peaty nature.

In the trials on swedes, artificial manures only were used; a basic dressing composed of three hundredweight of kainit and one hundredweight of sulphate of ammonia per statute acre being applied to each plot. In addition, one plot received a dressing of superphosphate at the rate of four hundredweight per statute acre, and the other two plots received equivalent quantities of North African Mineral phosphate and Clare phosphate respectively. Tests were laid down at 12 centres in Counties Clare, Galway and Roscommon. Apart from the fact that the crops on the plots to which superphosphate was applied made more rapid growth than the crops on the other plots in the early part of the season, there was no noticeable difference in the general appearance of the plants on the different plots. At three centres the plants on all three plots were affected by "finger and toe" disease. It was only in one case, however, that the disease did serious damage, and at that centre the yields were not determined. Weighings were taken at the remaining eleven centres, and the results obtained in each case and the average yield for all centres are set out in the following table:—

District	Character of Soil	Yield per statute acre					
		Plot I *Superphosphate* Kainit. Sulphate of Ammonia		Plot II *North African Mineral Phosphate* Kainit. Sulphate of Ammonia		Plot III *Clare Phosphate* Kainit. Sulphate of Ammonia	
		Tons	cwts.	Tons	cwts.	Tons	cwts.
Roscommon ...	Reclaimed bog	20	0	17	14	15	14
" ...	" "	14	11	10	0	7	17
Galway ...	" "	19	3	14	11	11	17
" ...	" "	18	11	14	6	12	0
" ...	Dark peat	23	17	23	0	12	10
" ...	Reclaimed bog	22	14	22	0	14	0
" ...	Heavy peat	21	8	25	4	25	14
Clare ...	Reclaimed bog	20	10	20	8	20	0
" ...	" "	14	10	13	13	10	11
" ...	" "	19	0	15	8	15	0
" ...	" "	28	3	25	11	23	11
Average yield per statute acre (11 centres)		20	10	18	7	15	7

It is noticeable that both Superphosphate and North African Mineral phosphate produced better results than Clare phosphate at all centres except one, and that, on the average, the returns produced by the latter phosphate

were definitely inferior to those obtained where superphosphate or North African Mineral phosphate was applied at an equivalent rate.

In the trials on meadow hay which were conducted at 21 centres, three plots, each one-eighth of a statute acre in size, were marked off at each centre. One plot was reserved as a control, and received no manurial treatment; another was dressed with one cwt. of North African Mineral Phosphate; and the third was treated with a similar quantity of Clare Phosphate. The manures were applied during the period, December, 1929, to January, 1930. During the early part of the growing season the manured plots made better growth than the untreated plots, but later in the year there was no very outstanding difference in the appearance of the herbage on the different plots. Owing to the unfavourable weather which prevailed throughout the hay-saving period of 1930, the quality of the hay produced at nearly all centres was not of a high standard. It was observed, however, that in general the quality of the hay from the manured plots was superior to that from the untreated plots.

The yields obtained at each centre, together with the average yield for the twenty-one centres are set out in the following table:—

Centre	Yields per statute acre.								
	North African Mineral Phosphate			Clare Phosphate			No Manure		
	Tons.	Cwts.	Qrs.	Tons.	Cwts.	Qrs.	Tons.	Cwts.	Qrs.
Ballinamore ...	2	1	—	2	5	3	1	19	—
Drumshambo ...	1	12	2	1	15	—	1	6	2
Castlerea	2	2	3	1	18	2	1	16	—
Athleague	1	18	—	1	9	1	1	8	2
Ballydangan ...	1	8	3	1	8	—	1	—	3
Strokestown ...	2	15	—	2	12	3	2	10	—
Headford	3	5	1	3	9	2	3	7	1
Glenamaddy ...	2	5	—	2	—	—	1	18	—
Glynsk	2	2	3	1	16	2	1	15	3
Ballyglunin	—	18	2	—	16	1	0	15	3
Menlough	1	18	2	1	14	1	1	8	2
Killimor	2	8	2	2	5	3	2	—	—
Woodford	2	3	1	1	10	3	1	10	—
Ardrahan	1	18	2	1	15	3	1	17	1
Clifden	2	7	3	2	2	—	1	19	3
Carna	2	16	—	2	11	—	2	3	3
Spiddal	1	14	—	1	10	—	1	9	2
Scariff	3	11	1	3	5	2	3	2	3
Kildysart	1	19	2	1	14	2	1	15	1
Lisdoonvarna ...	2	13	2	2	8	—	2	4	2
Kilkee	2	4	2	1	10	3	1	5	3
Average (21 centres) ...	2	4	0	2	0	0	1	16	0

At two centres slightly better yields were obtained from the unmanured plot than from that dressed with Clare phosphate, and in one case the control plot gave a better return than the plot treated with North African Mineral phosphate. The extra yield obtained from the unmanured plot at these particular centres was, however, in no case significant. On the average, and also at eighteen of the twenty-one centres at which the trials were conducted, better returns were obtained from the plot to which North African Mineral phosphate was applied than from the one dressed with Clare phosphate. At three centres the latter produced the better results, and on the average the Clare phosphate gave an increase of four hundredweight of hay per statute acre over the unmanured plots.

Tests on pasture were conducted at over 50 centres, and, as in the case of the other trials, the plots were in all cases located on peaty soils. Clare phosphate, Semsol, and North African mineral phosphate, respectively, were applied to three contiguous one-eighth acre plots at the rate of 8 cwt. per statute acre. In addition, an unmanured or control plot, was marked off at each centre. The manures were, with one or two exceptions, applied not later than the end of January, and the plots were inspected and reported upon at intervals during the season by the officers supervising the tests.

At all centres, except one, the pasture on the plots to which Semsol was applied, showed a distinct improvement over the unmanured plots in respect of earliness of growth, development of clovers and general appearance. With two or three exceptions, the North African mineral phosphate also effected a marked change in the general appearance of the pasture on the plots to which it was applied. In a few cases the results produced by the latter phosphate were equal to those secured where Semsol was applied. In general, however, the effects of the dressing of North African mineral phosphate were not noticeable early in the season, and it was in this respect mainly that it was inferior to Semsol. Clare phosphate, in comparison with the other phosphatic manures, gave very poor results, and it was only in three or four cases that the returns from it compared favourably with those produced by North African mineral phosphate. At about one-third of the centres no improvement in the pasture was noticed where it was applied, and at the majority of the remaining centres the plots dressed with Clare phosphate were but very slightly superior to the unmanured or control plots.

It is proposed to keep these plots under observation in 1931 and subsequent seasons with a view to determining the influence of the different dressings and particularly of the more insoluble phosphate, over an extended period.

PHOSPHATES AND POTASH ON PASTURE.

Reports on the results obtained during the first and second seasons in the grassland manurial trials with phosphates alone, and phosphates supplemented by potash, laid down by the Agricultural Instructors in the early spring of 1928 have already been published in the Department's Journal, Vols. XXVIII., No. 2, and XXX., No. 1. In general, it was found that

in both seasons the herbage on the plots top-dressed with phosphatic manures alone, and with phosphates supplemented by Kainit, showed a considerable improvement as regards earliness of growth, development of clovers and general appearance compared with the adjoining unmanured plots. At less than half the centres at which trials were conducted, the pasture on the plots to which both phosphates and potash were applied presented a slightly better appearance than that on the plots dressed with phosphates only. At the other centres no apparent benefit appeared to have been derived from the use of Kainit in addition to the phosphatic manure.

Reports received from the Agricultural Instructors at the end of the grazing season of 1930 indicated that, where either phosphatic manures or both phosphatic and potassic manures had been applied, the improvement in the pasture, as compared with the unmanured grassland, was even more marked than in the season in which the manures were applied or in the subsequent season. At about half the centres it was observed that the herbage on the plots top-dressed with both phosphatic and potassic manures appeared to contain more clovers and to be better relished by stock than that on the plots top-dressed with phosphates only. At the remaining centres there was no difference in the appearance of the pasture on the two sets of plots.

The results of these trials, extending over a period of three seasons, indicate generally that whilst the application of top-dressings of suitable phosphatic manures to grasslands almost invariably result in the production of better pasture, it is only on certain soils that any marked benefit is achieved by supplementing the phosphatic manures by a dressing of Kainit.

THE "NEW SYSTEM" OF GRASSLAND MANURING AND MANAGEMENT.

This system, which was fully described in a previous report—Department's Journal, Vol. XXVIII., No. 2—has been under trial in the Sáorstát at a large number of centres since 1928, and reports for that season and for the subsequent one have already been published in this Journal and also in the Annual Reports issued by the various County Committees of Agriculture. During the season of 1929 the trials were continued at twenty-one centres on the same general lines as in the previous seasons. In a number of cases, however, the system of manuring previously adopted was modified as a result of the experience already gained. For instance, at almost all centres the number of applications of nitrogenous manure was reduced from three to two, and at a few centres to one only. In a few cases, too, it was not considered necessary to apply a basal dressing of phosphates and potash, and at other centres phosphates only were applied in addition to the nitrogenous manures.

Reports received from all centres indicated that, as in the two previous years, the outstanding feature of these trials was the early growth of herb-

age on the pasture under treatment. In some cases the treated pastures were fit for grazing three to four weeks earlier than adjoining untreated grasslands of similar quality.

Notwithstanding the heavy dressings of nitrogenous manures applied during the past three years, the proportion of clovers to grasses showed no reduction, and the general improvement in the appearance of the pastures noticeable in the previous year was well maintained. The application of the first dressing of nitrogenous manure was, in all cases, followed by a rapid improvement in the growth of herbage. Similarly, increased development was noticeable shortly after the second dressing was applied. The results from the third application of nitrogenous manure at the centres where it was applied were, however, not very marked. Detailed particulars in respect of the quantities of manures applied at the different centres, the times of application, the numbers and kinds of stock grazed, and the quantity of milk produced where dairy cows were grazed, are to be found in the annual reports published by the County Committees of Agriculture.

FURTHER GRASSLAND MANURIAL TRIALS.

In connection with the trials of the " new system " of grassland management in progress since 1928, it has already been realised that, while the system has much to commend it, there are limits to its application in view of the expenditure required in connection with fencing, laying on of water, and purchase of manures. For this reason it is probable that the system in its entirety is not likely to be widely adopted by farmers in this country. Having regard to this fact and to the fact that phosphatic manures alone have been found to produce a marked improvement in pastures on almost all soils in this country, it was decided, at the end of the grazing season of 1929, to conduct a further series of grassland manurial trials to ascertain to what extent a single dressing of nitrogenous manure applied in early spring in addition to a basal dressing of phosphates and potash, would be effective in producing the " early bite " of grass so much needed for dairy cattle and sheep in the month of April when hand-feeding is usually scarce. Trials were conducted at 142 centres under the supervision of the Agricultural Instructors. At each centre four one-acre plots were marked off and treated as follows:—

Plot I.	No manure.
Plot II.	4 cwt. Semsol.
Plot III.	4 ,, Semsol.
	2 ,, Potash Salts.
Plot IV.	4 ,, Semsol.
	2 ,, Potash Salts.
	1 ,, Sulphate of Ammonia.

At all centres the effects of the manuring on the pasture were easily noticeable even early in the season. The effects were, however, most marked in the case of the plots to which the nitrogenous dressing was

applied. The pasture on the plots to which phosphates alone were applied was, on the average, fit to graze five or six days sooner than that on the control plots, and the herbage on the plots which received potash in addition was in many instances fit to graze a few days earlier still. In practically every case the herbage, on the plots to which the complete dressing was applied, was ready for grazing at least ten days before that on the earliest of the other manured plots, and almost three weeks earlier than the pasture on the unmanured portion of the land on which the trials were conducted.

At about two-thirds of the centres at which the tests were conducted, better results were obtained from the application of phosphates and potash than from the use of phosphates alone. At the remaining centres no advantage appeared to have been gained from the use of potash in addition to the phosphates. The Instructors were unanimous in stating that for the production of an " early bite " of grass, the one application of Sulphate of Amonia in addition to phosphates and potash was successful in practically every case. From June onwards, however, it was observed that there was little, if any, difference in the appearance or growth of the herbage on any of the manured plots. It was noticed that, in a number of cases, the pasture on the plots which received only phosphates and potash, or phosphates alone, was better relished by the cattle and eaten barer than that on the plots to which the complete dressing was applied. The herbage on these latter plots grew coarse and tufty in some instances. Towards the end of the grazing season, however, the stock grazing on the plots showed very little discrimination between the pasture on the various manured plots, and the number of centres where tufts of coarse grass appeared was small.

SUGAR BEET EXPERIMENTS, 1930.

PREVIOUS TRIALS.

Reports on the results of experiments on the cultivation of sugar beet which were conducted by the Department in each of the years 1925, 1926, 1927, 1928 and 1929 appeared in the following issues of the Department's Journal: Vol. XXVI., No. 1; Vol. XXVII., No. 1; Vol. XXVIII., No. 1; Vol. XXIX., No. 1; and Vol. XXX., No. 1, and also in pamphlet form.

THE 1930 EXPERIMENTS.

In the 1930 season the Department again arranged for the conduct of experiments with sugar beet under the supervision of the Agricultural Instructors, also at the Albert Agricultural College (University College, Dublin), and at the Department's Farms at Athenry, Ballyhaise and Clonakilty. These experiments embraced trials with varieties, manures and lime, and also tests in the cultivation of the crop.

I.—EXPERIMENTS CONDUCTED BY THE AGRICULTURAL INSTRUCTORS.

The experiments with sugar beet carried out by the Agricultural Instructors in 1930 consisted of trials with varieties and manures. These trials were confined to Counties Carlow, Kildare, Kilkenny, Laoighis, Louth, Offaly, Tipperary (N.R.), Waterford, Wexford and Wicklow, where the bulk of the supply for the Carlow factory was grown. Variety and manurial trials were conducted at four centres in each county with the exception of Wicklow and Louth. In Wicklow both series of trials were carried out at only two centres and in Louth only the variety trials were laid down. In all cases the selected plotholders were growers of beet under contract with the Carlow Factory. For the variety trials one-quarter statute acre at each centre was divided into four uniform plots, each comprising five drills, and for the manurial trials three-eights statute acre at each centre was divided into six uniform plots, each comprising five drills.

In 1928 and 1929, the Agricultural Instructors carried out variety trials to test the relative merits of the varieties Kuhn (P) and Kleinwanzleben (Z) by comparing them with varieties and strains which it was anticipated would produce an appreciably heavier crop of roots containing a slightly lower percentage of sugar. Kleinwanzleben (E) was the only one of these latter varieties or strains which gave returns as anticipated, but its relatively high average yield was practically offset by its low average percentage of sugar as compared with the corresponding returns from the Kuhn (P) and Kleinwanzleben (Z) varieties. Having regard to these results it was decided to include in the 1930 trials the Kleinwanzleben (N) strain which, in preliminary trials, had compared favourably with the Kleinwanzleben (Z) strain. The variety trials conducted by the Agricultural Instructors in 1930 were, therefore, confined to the Kuhn (P) variety and the (Z), (N) and (E) strains of the Kleinwanzleben variety. In all other respects these trials were conducted in 1930 on lines similar to those adopted in the two preceding years, as explained in the reports on the experiments carried out in those years.

In 1929 a second series of manurial trials with sugar beet was commenced, and in 1930 these trials were repeated on similar lines. The plots were laid down, in nearly every case, on land which, in the previous season, had been cropped with lea corn, and a dressing of farmyard manure was applied for the beet crop at the rate of 12 tons per statute acre either during winter before the land was ploughed or in the drills in spring before the seed was sown.

The following dressings of artificial manures were applied to the respective plots at each centre :—

Plot.	Manures.	
I.	12 tons farmyard manure	per statute acre.
II.	12 tons farmyard manure 4 cwt. superphosphate (35%) 4 cwt. Kainit. 1 cwt. sulphate of ammonia	per statute acre.
III.	12 tons farmyard manure 5 cwt. superphosphate (35%) 5 cwt. Kainit. 1¼ cwt. sulphate of ammonia.	per statute acre.
IV.	12 tons farmyard manure 6 cwt. superphosphate (35%). 6 cwt. Kainit. 1½ cwt. sulphate of ammonia.	per statute acre.
V.	12 tons farmyard manure. 4 cwt. superphosphate (35%). 4 cwt. Kainit. Nitro-chalk equivalent to 1 cwt. sulphate of ammonia.	per statute acre.
VI.	12 tons farmyard manure. 4 cwt. superphosphate (35%). Muriate of potash equivalent to 4 cwt. Kainit. 1 cwt. sulphate of ammonia.	per statute acre.

The artificial manures were applied immediately before the seed was sown and the Kuhn (P) variety of seed was sown on all the plots at all centres. The general cultivation of the crop on these plots was the same as in the case of the variety trials already referred to.

Weather Conditions.

From the early part of November, 1929, to the beginning of February, 1930, the rainfall was excessive. The first three weeks of February were dry and harsh, and the period from the end of that month to mid-April was wet and cold. Then ensued a month of rather dry, harsh weather which was broken by heavy thunder storms about mid-May. Dry, warm weather prevailed during the latter part of May and most of June. From 19th June to the end of July the weather became increasingly unsettled and cool. August was a cool and very wet month, followed by a period of excessive rainfall

and moderate temperatures, which lasted until the middle of October. During the latter half of October and the first week of November the weather was rather dry and mild, after which the remainder of the year was somewhat variable and unsettled, though devoid of extremes.

Preparation of the Land for Seeding.

Because of the wet winter and spring the ploughing of land was, in most cases, delayed until February or March, and it was only on the lighter soils that preparations for seeding could be carried out early and without difficulty. The majority of the plotholders applied the farmyard manure for the beet crop in the drills immediately before the seed was sown. A few plotholders grew the beet after a manured crop and applied artificial manures only.

Seeding.

In 1930, as in the two previous seasons, one series of variety trials was conducted by Agricultural Instructors, and a second series was carried out at the Department's Farms and at the Albert Agricultural College. The seed of the different varieties was obtained direct from the producers and before it was distributed bulk samples representative of each of the thirteen varieties and strains were drawn and tested at the Department's Seed Testing Station with the following results :—

TABLE I.

STRAIN OF SEED	Germination per cent.		Number of Seedlings per Kilo.	Weight of 1,000 clusters (gms.)	Moisture per cent.	Purity per cent.
	Clusters	Seedlings				
Kuhn (P)	86	128	50,985	25·07	11·27	99·63
Kleinwanzleben (N) ...	77	167	72,419	23·09	10·89	99·60
,, (Z) ...	80	180	83,349	21·62	10·90	99·47
,, (E) ...	76	161	75,246	21·37	10·88	99·93
Schreiber (S.K.W.) ...	74	137	60,585	22·58	10·91	99·57
,, (SO) ...	88	203	74,185	27·31	11·10	99·58
,, (SS) ...	94	200	77,250	25·86	10·59	99·84
Buszczynski (NP) ...	93	178	84,013	20·735	11·48	99·84
,, (P) ...	84	168	71,355	23·25	11·06	99·15
Garton (A)	82	162	77,136	18·93	10·65	99·37
Johnson's (Perfection)	87	152	80,569	17·935	10·19	98·42
Marster's (Hilleshog) ...	92	209	79,809	25·185	10·43	99·69

STRAIN OF SEED	SOURCE OF SEED.
Kuhn (P)	Messrs Kuhn & Co., Naarden, Holland.
Kleinwanzleben (N) ...	,, Zuckerfabrik Kleinwanzleben, (Bejerk-Magdeburg), Germany.
,, (Z) ...	,, ,, ,, ,,
,, (E) ...	,, ,, ,, ,,
Schreiber (S.K.W.) ...	,, G. Schreiber & Zohn, Nordhausen (Harz), Germany.
,, (SO) ...	,, ,, ,, ,,
,, (SS) ...	,, ,, ,, ,, ,,
Buszczynski (NP) ...	,, K. Buszczynski & Sons, Ltd., Warsaw, Poland.
,, (P) ...	,, ,, ,, ,,
Garton (A)	,, Gartons, Ltd., Warrington, England.
Johnson's (Perfection)	,, W. W. Johnson & Son, Ltd., Boston, Lincs., England.
Marster's (Hilleshog) ...	,, C. W. Marsters, King's Lynn, Norfolk, England.

Owing to unfavourable conditions at sowing time the seed brairded rather thinly and irregularly at a number of centres, and as a result, the stand of

TABLE No. II.

Showing Results of Variety Trials Conducted by the Agricultural Instructors.

No.	County	Name and Address of Plotholder	Nature of Soil	Crop grown on land in 1929	Date of Sowing	Date of Singling	Date of Weighing Crop	Yield per Statute Acre (Factory Weight) Kuhn (P) Strain	Kleinwanzleben (Z) Strain	Kleinwanzleben (E) Strain	Kleinwanzleben (N) Strain	Sugar Content of Roots Kuhn (P) Strain	Kleinwanzleben (Z) Strain	Kleinwanzleben (E) Strain	Kleinwanzleben (N) Strain
								T. C.	T. C.	T. C.	T. C.	%	%	%	%
38	Carlow ..	Doran, Thomas, Kilcruit, Bagenalstown.	Good Medium Loam	Sugar Beet	2 May	6 June	6 Nov.	14 5	14 15	17 13	18 13	17·4	18·4	17·7	18·6
54		Mahon, John, Bennekerry, Carlow.	Medium Loam	Turnips	26 April	29 May	11 Nov.	12 3	13 3	16 1	15 18	19·1	18·7	18·0	18·0
64		Murphy, Joseph M., Rathlyon, Tullow.	Light Sandy Loam	Potatoes	1 May	7 June	22 Nov.	8 6	7 13	8 8	8 11	18·2	18·1	19·6	19·1
67		Hayes, James, Marley, Borris	Medium Loam	Turnips	30 April	2 June	27 Nov.	14 6	15 1	15 15	15 11	19·0	19·1	18·4	18·3
4	Kildare ..	Kelly, Thomas, Killeen, Narraghmore.	Loam	Oats	2 May	12 June	28 Oct.	12 6	11 12	13 6	12 4	18·2	18·4	16·9	18·3
17		Mahon, William, Prusselstown, Athy.	Loam	Potatoes	25 April	16 June	31 Oct.	12 11	11 14	13 2	12 18	18·0	18·0	17·5	18·1
24		Speirs, Archibald L., Burtown, Athy.	Loam	Lea Oats	14 May	26 June	4 Nov.	10 18	10 12	11 8	10 18	18·4	18·6	17·2	18·3
76		Kehoe, Patrick, Newlands, Naas	Loam	Lea Oats	6 May	17 June	3 Dec.	10 10	10 16	12 14	12 5	18·0	18·0	17·0	17·8
6	Kilkenny ..	Maher Bros., Messrs., Freshford.	Medium Friable Loam	Turnips	28 April	29 May	28 Oct.	20 2	18 7	20 1	20 0	18·3	17·3	17·1	17·6
29		Darcy, Mrs. Annie, Ullard, Borris.	Medium Granite Loam	Sugar Beet	4 May	10 June	4 Nov.	14 6	12 3	14 4	14 4	18·2	17·7	17·6	17·1
15		Hughes, Nicholas, Balief, Woodsgift.	Medium Loam	Potatoes	29 April	2 June	10 Nov.	12 1	10 17	11 16	11 5	19·3	18·9	18·1	19·0
75		Murphy, Martin J., Rathelough, Danesfort.	Clay Loam	Oats	15 May	30 June	4 Dec.	11 1	9 12	11 8	11 0	18·3	19·4	18·0	18·2
9	Laoighis ..	Lalor, Mat, Ballycarney, Portlaoighise.	Loam	Oats	8 May	17 June	28 Oct.	6 13	9 6	10 9	9 0	18·6	17·7	17·4	18·0
18		Larkin, James, Irishtown, Mountmellick.	Light Black Moor	Oats	19 May	23 June	31 Oct.	5 3	6 3	6 4	6 6	17·2	16·6	16·3	16·4
19		Whelan, Edward, Pallas, Portlaoighise.	Light Clay Loam	Oats	2 May	24 June	30 Oct.	8 1	8 0	8 16	9 7	16·6	16·9	16·1	16·0
66		Conroy, Rd., Clonad, Portlaoighise.	Light Sandy Loam	Barley	3 May	9 June	27 Nov.	11 6	11 2	13 10	13 0	18·0	17·8	17·8	18·3
51	Louth ..	McKevitt, Thomas, Carrickrobin, Kilkerley, Dundalk.	Medium Clay	Lea Oats	5 May	12 June	13 Nov.	16 7	14 14	13 9	13 0	18·6	18·4	18·1	18·0
61		McArdle, Peter, Faugart House, Dundalk.	Clay	Rye and Vetches	22 May	25 June	20 Nov.	13 6	10 9	12 3	11 1	17·5	17·0	17·0	17.0
65		Halpenny, John, Oberstown, Ardee.	Clay	Lea Oats	16 May	17 June	27 Nov.	11 5	10 5	15 4	11 14	17·4	18·7	17·5	18·1
79		Malone, Michael, Rathcor, Riverstown, Dundalk.	Light Clay	Oats	10 May	18 June	11 Dec.	12 18	10 7	11 0	9 13	17·7	19·2	18·8	18·7
31	Offaly ..	Kelly, Michael, Cloncon, Tullamore.	Medium Loam	Turnips	6 May	16 June	5 Nov.	12 15	11 17	13 4	11 17	18·1	17·7	18·0	18·0
58		Keegan, William, Sragh, Tullamore.	Loam	Potatoes	12 May	24 June	15 Nov.	11 10	10 18	12 0	11 14	18·7	18·0	19·0	18·4
70		Kinnarney, Patrick, Hawkswood, Killeigh, Tullamore.	Strong Moor	Turnips	28 April	8 June	27 Nov.	13 15	12 14	13 18	14 3	17·0	17·5	17·3	17·4
69		Meleady, James, Ballydaly, Tullamore.	Sandy Loam	Barley	19 May	23 June	29 Nov.	9 12	9 5	10 2	9 16	18·1	18·2	17·4	18·3
2	Tipperary N.R.	Brennan, John, Castleing, Templemore.	Clay Loam	Corn	14 May	26 June	27 Oct.	10 2	9 1	10 13	11 3	17·7	18·0	16·8	17·8
16		Lehane, James, Ballykinash, Carrig, Birr.	Sharp Clay	Oats	5 May	28 June	30 Oct.	7 19	8 3	8 18	8 18	18·2	18·4	17·4	18·0
23		Letsom, R., Corville, Roscrea	Dark Clay Loam	Corn	13 May	27 June	4 Nov.	8 7	8 6	7 6	8 12	18·2	17·6	18·4	18·7
36		Maxwell, M. Glenalbert, Roscrea.	Strong Clay	Lea Oats	16 May	28 June	6 Nov.	10 12	10 3	10 3	9 16	18·1	17·7	17·6	18·1
8	Waterford ..	Kiely, Michael, Ballinhassery, Dungarvan.	Deep Sandy Loam	Potatoes	8 April	6 May	29 Oct.	21 0	20 13	23 4	22 14	18·1	19·0	19·0	17·2
14		Coleman, Wm., Ballinaroone, Ballyduff.	Alluvial Loam	Lea Oats	30 April	5 June	30 Oct.	13 13	18 2	17 11	17 13	17·4	17·7	17·2	17·5
25		O'Brien, Ml., Bewley, Cappoquin.	Limestone Loam	Lea Oats	2 May	28 May	3 Nov.	15 16	13 18	15 0	16 12	18·4	19·0	17·7	17·4
11		Flynn, P., Kilcannon, Cappagh	Shingly Loam	Lea Oats	2 May	30 May	10 Nov.	15 15	15 2	19 1	16 5	19·0	19·0	17·2	18·3
1	Wexford ..	Poole, A., Ballylinogue, Killinick.	Shingly Loam	Oats	28 April	7 June	27 Oct.	11 18	12 3	14 3	11 12	17·6	18·0	14·9	16·6
3		Anglim, D. V., Ballyregan, Tagoat.	Loam	Barley	28 April	9 June	28 Oct.	14 18	15 0	14 15	14 15	18·2	18·3	17·0	18·1
43		Foley, James, Rathinney, New Ross.	Deep Friable Loam	Potatoes	25 April	23 May	10 Nov.	14 6	15 3	15 12	14 15	18·0	18·6	18·1	19·2
18		Scallan, Peter, Clonroche ..	Sandy	Sugar Beet	2 May	9 June	12 Nov.	9 3	10 0	11 9	9 15	19·2	19·0	18·6	19·5
28	Wicklow ..	Kehoe, Daniel, Baltinglass ..	Medium Loam	Potatoes	15 May	21 June	5 Nov.	9 18	9 16	10 7	9 9	19·4	19·1	17·7	19·0
63		Donegan, Nicholas, Tinorin, Baltinglass.	Rich Loam	Turnips	6 May	13 June	21 Nov.	12 18	12 6	13 4	12 1	19·1	18·2	17·4	18·1
					Average	for 38 Plots		12 7	11 16	13 2	12 12	18·2	18·2	17·6	18·0

of artificials applied to Plot II, whereas the corresponding returns from

... summaries of the results appearing in Tables II and III are shown in Tables IV and V, respectively.

TABLE

Showing Results of Manurial Trials Conducted

No.	Name and Address of Plotholder	Soil: Description	Soil: pH. Value	Date of Sowing	Date of Singling	Date of Weighing Crop
	CARLOW					
42	Nolan, James, Powerstown, Milford	Light Limestone Gravel	6·4	22 April	21 May	5 Nov.
72	Murphy, Mrs. B., Ballyloo, Carlow	Light Loam	7·8	24 April	20 May	2 Dec.
	KILDARE.					
11	Kelly, Thomas, Killeen, Narraghmore	Loam	7·9	2 May	14 June	29 Oct.
15	Mahon, William, Prusselstown, Athy	Loam	7·7	5 May	20 June	30 Oct.
22	Speirs, Archibald L., Burtown, Athy	Loam	7·6	14 May	24 June	3 Nov.
77	Kehoe, Patrick, Newlands, Naas	Loam	7·9	6 May	16 June	4 Dec.
	KILKENNY.					
26	Dullard, Thomas, Boher, Bennettsbridge	Medium Loam	7·5	6 May	10 June	3 Nov.
33	McEvoy, William, Ballycoura, Ballyraggett	Medium Loam	7·6	5 May	14 June	6 Nov.
34	Gannon, James, Oldtown, Ballyraggett	Medium Loam	7·6	5 May	11 June	7 Nov.
78	Walsh, John, Ballinalina, Kilkenny	Medium Loam	7·5	15 May	28 June	6 Dec.
	LAOIGHIS.					
10	Mitchell, Ed., Ballina, Portlaoighise	Loam	5·6	5 May	16 June	27 Oct.
27	Brady, L., Lalor's Mills, Portlaoighise	Light Loam	7·6	12 May	24 June	3 Nov.
37	Harte, P., Anster, Ballacolla	Light Loam	8·0	7 May	16 June	6 Nov.
53	Neary, Joseph, Cullohill, Rathdowney	Light Loam	7·5	6 May	20 June	14 Nov.
	OFFALY.					
55	Foy, John, Welsh Island, Geashill	Clay Loam	7·4	3 May	29 June	14 Nov.
52	Carroll, Lawrence, Clonad, Killeigh, Tullamore ..	Strong Moor	7·8	16 May	30 June	12 Nov.
50	Byrne, John, Knock, Daingean	Strong Loam	7·2	13 May	25 June	11 Nov.
56	Kelly, Hugh, Welsh Island, Geashill	Loam	7·5	3 May	23 June	13 Nov.
	TIPPERARY (N.R.).					
21	Boylan, Thomas, Curraduff, Killeen, Birr	Stiff Dark Clay	7·9	5 May	28 June	3 Nov.
32	Cross, James P., Norwood, Nenagh	Strong Clay	6·3	15 May	30 June	5 Nov.
40	Brennan, John, Ballinroe, Templemore	Medium Loam	7·8	19 May	5 July	7 Nov.
	WATERFORD.					
7	O'Brien, Michael, Bewley, Cappoquin	Medium Limestone Loam	6·5	2 May	28 May	28 Oct.
5	Flynn, Patrick, Kilcannon, Cappagh	Shingly Loam	6·2	2 May	28 May	27 Oct.
30	Morrissey, G., Ballinaskeagh, Dungarvan	Deep Drift Loam	7·9	30 April	5 June	6 Nov.
62	Butler, J., Liccaun, Dunmore East	Medium Sandstone Loam	7·3	3 May	19 June	22 Nov.
	WEXFORD.					
13	Cullen, J., Boley, Ballycullane	Sandy Loam	6·9	1 May	11 June	30 Oct.
20	Cummins, T., Shielboggin, Ramsgrange	Sandy Loam	7·0	27 April	13 June	3 Nov.
57	Roche, Patrick, Blackhall, Glynn	Sandy	5·8	2 May	11 June	17 Nov.
68	Furlong, Thomas, Knockreigh, Adamstown	Shingly Loam	5·7	14 May	1 July	28 Nov.
	WICKLOW.					
35	Donegan, James, Kilmurray, Baltinglass	Medium Loam	5·8	5 May	16 June	6 Nov.
71	Burke, Michael, Lackeragh, Baltinglass	Rich Medium Loam	5·7	7 May	21 June	29 Nov.
			Average for 31 Plots		..	..

No. III.

BY THE AGRICULTURAL INSTRUCTORS.

Yield per Statute Acre (Factory Weight)						Sugar Content of Roots.					
Farm-yard Manure *only*	Cwt. 4 Super 4 Kainit 1 Sulph. Ammonia	Cwt. 5 Super 5 Kainit 1¼ Sulph. Ammonia	Cwt. 6 Super 6 Kainit 1½ Sulph. Ammonia	Cwt. 4 Super 4 Kainit Nitro-chalk	Cwt. 4 Super Muriate of Potash 1 Sulph. Ammonia	Cwt. Farm-yard Manure only	Cwt. 4 Super 4 Kainit 1 Sulph. Ammonia	Cwt. 5 Super 5 Kainit 1¼ Sulph. Ammonia	Cwt. 6 Super 6 Kainit 1½ Sulph. Ammonia	Cwt. 4 Super 4 Kainit Nitro-chalk	Cwt. 4 Super Muriate of Potash 1 Sulph. Ammonia
	In addition to 12 Tons Farmyard Manure						*In addition to 12 Tons Farmyard Manure*				
T. C.	T. C.	T. C.	T. C.	T. C.	T. C.	%	%	%	%	%	%
14 6	17 6	18 3	18 6	17 8	17 10	18·6	19·5	19·0	20·0	19·6	19·2
13 6	16 14	17 6	17 4	16 13	16 3	18·0	19·0	18·9	19·4	19·0	18·3
8 15	12 4	13 2	13 4	11 14	11 0	17·7	18·5	18·4	18·0	18·4	18·3
7 2	9 14	10 10	10 8	9 2	9 8	18·4	18·3	18·4	18·0	18·5	18·2
7 14	10 17	11 6	11 10	10 10	9 16	18·2	17·7	19·3	18·5	18·2	18·3
7 13	10 12	11 13	11 12	10 8	9 15	19·4	18·4	17·5	18·6	17·6	18·1
12 0	12 14	13 17	12 15	13 4	12 14	18·2	18·6	19·2	19·2	19·6	18·5
11 4	13 1	13 17	14 3	13 15	12 7	19·9	20·4	19·2	19·0	19·4	19·0
10 10	12 6	13 0	14 0	13 10	15 1	18·1	19·4	19·7	18·0	18·0	17·6
11 1	12 14	13 11	15 9	13 16	12 10	18·1	18·6	18·5	18·0	18·7	19·0
6 9	9 4	11 17	11 10	12 9	9 10	18·1	18·1	18·2	[illegible]	19·0	18·3
6 0	10 1	11 9	11 11	9 9	9 15	18·0	18·7	19·1	19·2	19·2	19·3
9 15	12 3	12 10	12 16	10 12	12 5	18·0	18·0	17·4	18·3	18·1	17·6
7 12	9 6	9 15	9 18	9 3	9 6	19·3	19·0	20·0	20·0	19·6	19·4
9 14	12 8	13 5	12 17	11 9	10 10	19·0	19·0	18·5	18·2	19·3	18·1
7 4	9 14	10 7	10 7	10 0	9 10	17·7	19·4	18·2	18·0	18·0	17·5
9 15	11 17	12 2	13 4	12 0	11 15	17·4	18·0	19·7	19·0	19·0	17·4
7 18	12 10	12 4	12 10	11 8	11 0	18·0	18·5	17·5	18·2	18·1	18·2
9 0	10 2	9 18	9 0	9 17	11 6	17·7	16·7	17·1	18·2	17·1	17·2
9 12	8 12	8 12	8 4	8 6	7 9	17·6	18·2	18·7	18·4	18·7	18·0
8 12	8 16	9 10	11 6	10 18	10 11	19·4	19·0	19·1	18·4	19·0	19·3
10 14	16 0	17 6	16 5	16 8	15 14	17·2	17·6	18·0	17·6	18·1	18·0
8 12	12 19	16 9	16 5	16 11	16 6	18·0	18·1	18·4	16·7	17·7	17·5
7 13	12 9	10 2	12 2	11 16	11 10	17·0	19·1	19·5	18·5	19·0	18·3
14 1	16 6	14 18	16 10	15 18	17 9	18·0	17·4	17·4	17·0	16·5	17·0
6 15	13 0	12 12	12 3	11 15	11 9	17·3	18·0	18·0	18·2	17·5	17·9
8 18	14 3	13 6	15 12	12 0	12 6	18·4	18·7	18·8	18·5	18·5	18·1
10 3	13 9	14 6	14 15	13 6	13 6	19·3	18·5	19·1	19·3	19·5	19·0
3 12	8 18	9 3	9 0	8 3	7 15	20·0	19·1	18·0	20·0	19·1	19·0
11 9	14 8	14 15	15 6	14 0	14 7	18·3	19·1	19·5	19·1	18·7	19·4
9 11	14 0	14 15	14 19	14 4	13 16	18·3	18·1	18·0	18·0	18·1	18·0
9 5	12 4	12 15	13 1	12 5	12 1	18·3	18·5	18·6	18·5	18·5	18·3

the crop was somewhat patchy at about 20 per cent. of the total number of centres where the variety and manurial trials were conducted.

Singling and After-Cultivation.

Singling of the crop at the majority of centres was carried out when the plants had developed four leaves exclusive of the two primary seed leaves. At about 25 per cent. of the centres the plants were singled within five weeks after the date of sowing, while at about 35 per cent. of the centres singling did not take place for more than seven weeks after the date of sowing. Some difficulty was experienced in controlling the growth of weeds but there were no cases of serious neglect of after-cultivation.

Harvesting.

According to the information gained in previous years and also to the results obtained each year since 1925 from fortnightly weighings and analyses of samples of beet drawn at selected centres, the optimum quantity of sugar is attained in November. It was, therefore, decided to complete, so far as possible in the month of November, the recording of the yield (tonnage) from the 1929 experimental plots and the sugar content of their produce.

The procedure adopted in ascertaining the yield of the crop on the various sub-plots was as follows:—An area of two statute perches representative of the general crop on each sub-plot was accurately measured off. The beets were lifted by hand, with the aid of a fork where necessary. Those which had bolted or were abnormally small were discarded. All loosely adhering soil was removed by scraping the roots with the back of the topping knife, after which the leaves and crown were cut off squarely at the point where the lowest leaf had originally appeared. When the roots from the measured area of two statute perches were scraped and topped, one quarter, by weight, of the roots was selected, having due regard to size and shape. From the roots, so selected, any branches or fangs, or portions thereof, of the thickness of an ordinary lead pencil were cut off, after which each root was thoroughly cleaned by washing and scrubbing. From the weight of such washed roots the "factory weight" for the produce of the whole sub-plot was then calculated.

After the roots had been weighed to ascertain the yield, a representative sample consisting of ten of the topped and washed roots from each sub-plot was despatched to the State Laboratory in Dublin, where, immediately after arrival, each sample was analysed for sugar content in accordance with the usual practice adopted by beet sugar factories.

Of the 72 centres where experiments were laid down, complete returns were obtained from 69 centres. From three centres reliable records could not be obtained from all the sub-plots for the following reasons:—The crop at one centre was damaged by crown rot and at another centre the crop grown on the experimental plot was lifted before weighings and samples could be obtained. At the remaining centre, the experiments were not conducted in accordance with the scheme.

Detailed particulars in respect of all centres from which complete returns were obtained are shown in Table II, referring to variety trials, and Table III, which has reference to the manurial trials. Summaries of the results appearing in Tables II and III are shown in Tables IV and V, respectively.

The average returns from the 38 centres where 152 variety sub-plots were laid down are shown in Table IV. A comparison of the returns from the Kuhn (P) and Kleinwanzleben (Z) varieties bears out the results of previous trials, namely—that these varieties are equal in sugar content but that Kuhn (P) is somewhat superior in yield and resistance to bolting. The average returns in Table IV show that, as regards yield and sugar content, the three Kleinwanzleben strains are quite true to type. The (E) strain is characterised by a relatively high yield and low sugar content as compared with the (Z) strain, whereas the intermediate (N) strain approximates closely to the (E) strain as regards yield and to the (Z) strain as regards percentage of sugar in roots.

The average returns from the 186 manurial sub-plots which were laid down at 31 centres are shown in Table V. The relation between the average yields obtained from the series of six sub-plots laid down at each centre agrees closely with that of the same series of trials carried out in the previous year. The differences in the yield of the various sub-plots were, however, somewhat greater in the 1930 season. The differences as regards the percentage of sugar in the samples of roots drawn from the various sub-plots were very slight in both years, but such variations were somewhat greater in 1929, and the differences in sugar content as between the returns from the various sub-plots did not bear quite the same relation in both years.

Although the average yield of the crops on Plot I is much below the corresponding returns from the crops on any of the other plots the satisfactory nature of the returns from Plot I at the majority of centres, indicates that in general the soils selected for these trials were in a good state of fertility. At 8 out of the 11 centres where the yield from this plot fell below 8½ tons the crops were patchy. Examination of the complete returns from 11 centres where the yields on Plot I were less than 8½ tons and from 10 centres where the yields on this plot were more than 10 tons per statute acre, shows that the better crops received more timely attention as regards the important details of culture, which are discussed on a subsequent page. As a result, perhaps, of favourable weather conditions during the early stages of growth, there was no very marked difference as regards sugar content, between the crops on the plots which produced yields well above and below average. At the 12 centres where the farmyard manure was ploughed in during winter the average yield per acre was fully 2 tons more, and the crop was singled on the average one week earlier than at the 18 centres where the farmyard manure was applied in the drills immediately before the seed was sown.

Although the average returns from the other plots in the series differed only slightly as regards yield and even less as regards sugar content, the estimated value per acre of the crops on these plots differed appreciably. The increased monetary return from Plot II, which received 9 cwts. of the standard manurial dressing, as compared with Plot I was at the average rate of £6 [illegible]s. 5d. per statute acre after allowing for the cost of the dressing of artificials applied to Plot II, whereas the corresponding returns from

Plots V and VI were £5 19s. 6d. and £5 11s. 3d., respectively. The larger quantities of the standard mixture, *i.e.*, 11¼ cwts. and 13½ cwts. (Plots III and IV) as against 9 cwts. (Plot II) per statute acre produced heavier crops of beet containing an equal percentage of sugar, but there was very little difference in the net value of the increased returns as between Plots III and IV. On Plot V, which received nitro-chalk instead of sulphate of ammonia, the average yield and sugar content of the crops was practically equal to the corresponding returns from Plot II, to which the standard dressing was applied. The returns from the different centres afford some evidence that nitro-chalk may prove to be a satisfactory source of nitrogen for sugar beet when grown on land which is deficient in lime. In the case of Plot VI, which received muriate of potash instead of kainit, both the average yield and sugar content were lower than in the case of Plot II, which received an equivalent quantity of potash in the form of kainit.

Having regard to the results obtained in the experiments conducted in 1930 and in previous years, it is evident that a mixture composed of 4 cwt. superphosphate, 4 cwt. kainit and 1 cwt. sulphate of ammonia can be relied upon to give satisfactory results on most soils. The rate at which this mixture should be applied will depend mainly on the nature of the soil and the quantity and quality of the supplemental dressing of farmyard manure. With a moderate dressing of farmyard manure the mixture of artificials should be applied at the rate of 9 cwt. per statute acre, but in cases where farmyard manure is not applied directly to the beet crop or where the soil is in a rather poor state of fertility the dressing of artificials may be increased by as much as 50 per cent. with profitable results. In addition, a top-dressing of nitrate of soda at the rate of about one cwt. per statute acre should be applied a few days after the crop is singled, or even before singling, where the crop is attacked by insect pests or where growth has been seriously interfered with through adverse weather conditions or other causes.

Soils.

It will be observed from Table VI that at the majority of centres where the experiments were conducted the soil was described as medium loam. A comparison of the returns from all centres, according to the description of soil on which each crop was grown shows that on the average the crops grown on soils described as " light " and " medium " were superior as regards yield and sugar content to the crops grown on soils described as " heavy " and " moory." The sugar content of the beet grown on the lighter upland soils was, on the average, higher than that of the beet grown on heavier soils.

At those centres where manurial trials were conducted, samples of soil from the plots which received farmyard manure only were tested in order to determine their hydrogen-ion concentration or pH value, the object being to study the relation, if any, between the lime requirements of the different soils, as indicated by this test, and the results obtained from the different dressings of artificial manures. As reported in this Journal (Vol. XXIX,

No. 1), a soil is regarded as neutral at pH 7.0 and in this country it has been found that there is a risk of failure when beet is grown on soils as acid as pH 5 or as alkaline as pH 8, but that there is a region of safety between the values of pH 5.3 and pH 7.8.

Reference to Table III shows that whilst the soils at ten centres were below pH 7.0 they were sufficiently above pH 5.3 to produce satisfactory crops, excepting those at two centres where the crops were patchy. On the other hand, the soils at twelve centres were above pH 7.5, or decidedly alkaline, and whilst these soils produced fair to good crops, their average yield was two tons below the average yield where the soils were less alkaline or even definitely acid. On the soils which were either more acid or more alkaline, the beet crop would probably not have done so well but for the moist growing season in 1930.

Influence of place in Rotation.

Examination of the returns from the variety and manurial experiments with particular reference to the place which the beet crop occupied in the rotation shows that on the average the most satisfactory yields of roots and sugar were obtained from beet grown after a manured crop and after lea corn. Where the beet was grown after lea corn which had received a dressing of artificial manure, the returns were much the same as where the corn had received no artificials.

[TABLE VI.

TABLE No. VI.

SHOWING THE RESULTS OF A SURVEY OF THE RETURN IN RESPECT OF CENTRES SHOWN IN TABLES II. AND III.

	Variety Trials (Table II)				Manurial Trials (Table III)			
	No. of Cases	Average: Yield of Roots per acre	Average: Sugar Content of Roots	Average: Yield of Sugar per acre	No. of Cases	Average: Yield of Roots per acre	Average: Sugar Content of Roots	Average: Yield of Sugar per acre
		T. C.	per cent.	Tons		T. C.	per cent.	Tons
AVERAGE OF ALL PLOTS	38	12 9	17·9	2·23	31	11 18	18·5	2·20
Soils:								
Light	5	12 9	18·4	2·29	8	12 13	18·7	2·37
Medium	23	12 17	18·0	2·31	18	12 1	18·4	2·22
Heavy	8	12 1	17·8	2·14	4	10 9	18·2	1·90
Moory	2	9 15	17·0	1·66	1	9 10	18·4	1·72
Rotations:								
Roots 1929; Corn 1928	16	13 13	18·3	2·50	—	—	—	—
Corn 1929; Roots 1928	8	10 1	17·9	1·20	3	10 15	18·5	1·99
Corn 1929; Corn 1928	2	11 0	18·0	1·98	3	11 3	18·9	2·11
Corn 1929; Grass 1928	10	13 1	17·7	2·31	25	12 3	18·4	2·24
Lea Corn 1929 (manured) ...	—	—	—	—	12	12 1	18·5	2·23
Lea Corn 1929 (no manure) ...	—	—	—	—	16	12 0	18·4	2·21
Manures:								
Farmyard Manure applied in Winter	11	12 10	17·9	2·24	12	13 5	18·5	2·45
Do. do. Spring	15	12 0	17·9	2·15	18	11 3	18·5	2·06
Dates of Sowing:								
April	11	15 7	17·9	2·75	4	14 5	18·8	2·68
1st to 7th May (inclusive) ...	13	12 6	17·9	2·20	19	12 4	18·3	2·23
After 7th May	14	10 6	18·0	1·85	8	10 1	18·6	1·87
Period of Growth:								
a) From Sowing to Singling:								
Up to 35 days (inclusive) ...	12	13 16	18·1	2·50	5	13 5	18·5	2·45
Between 35 and 43 days ...	17	12 15	18·0	2·30	10	11 16	18·5	2·18
More than 42 days	9	10 3	17·9	1·82	16	10 19	18·4	2·01
b) From Sowing to Lifting:								
Up to 180 days, inclusive ...	9	9 11	17·9	1·71	11	11 4	18·4	2·06
From 180 to 200 days, inclusive	21	13 10	18·0	2·42	14	11 9	18·6	2·20
More than 200 days ...	8	13 1	18·2	2·38	6	14 7	18·4	2·64
Width of Drills:								
Less than 22 inches	9	15 2	18·0	2·72	9	13 3	18·3	2·41
22 inches	20	12 0	18·0	2·16	15	11 6	18·5	2·09
More than 22 inches	9	10 16	17·9	1·93	7	11 13	18·5	2·16
Stand of Crops:								
Patchy	4	8 2	17.4	1.41	11	10 4	18.6	1.90
Regular	34	12 19	18.0	2.33	20	12 17	18.4	2.36

Manuring.

It will be observed from Table VI that at a majority of centres the farmyard manure was applied in the drills immediately before the seed was sown, but that the yield was higher on the average at those centres where farmyard manure was ploughed in during winter. Where the beet crop was grown after roots and no farmyard manure was applied directly to the beet crop, the average yield and sugar content of the crops were above the general average.

Dates of Sowing, Singling and Lifting.

Although the dates of sowing, singling and lifting of the beet at the various centres depended on very different circumstances, comparisons of the average returns from all the centres indicate that the period at which these operations were performed and the length of time between these operations had a marked effect on the yield and a slight influence on the sugar content of the beet.

Approximately 22 per cent. of the total number of plots were sown in April; 46 per cent. during the first week of May and 32 per cent. after 7th May. The best average yield was obtained from the plots sown in April and the average yield from the plots sown during the 1st week of May was better than that from plots sown after 7th May. The date of sowing, apart from other factors, appears to have had a very slight influence on the percentage of sugar in the roots.

The average returns show that much better yields and a slight improvement in sugar content were obtained where the crops were singled early.

At 30 per cent. of the total number of centres the crop was lifted within a period of 180 days from the date of sowing: at 50 per cent. of the total number of centres this period varied from 180 to 200 days, and at the remaining centres more than 200 days elapsed between the sowing and lifting of the crop. Those crops which were harvested when the period of growth had exceeded 180 days produced a much heavier average yield of roots containing a slightly higher average percentage of sugar than was obtained from the crops harvested within a lesser period.

From the foregoing observations it is evident that when other conditions are favourable the maximum returns as regards yield and sugar content are most likely to be obtained where the crop is sown early in the season under such conditions that the seed germinates quickly and the plants develop rapidly to the singling stage and where the crop is allowed fully six months in which to reach maturity.

Width of Drills.

The width of the drills was 22 inches at approximately 50 per cent. of the total number of centres; it was less than 22 inches at approximately 25 per cent. of the centres and at the remaining centres the width of the drills, exceeded 22 inches. As compared with the average yield of roots produced on 22 inch drills the average yield was much higher on drills less than 22 inches in width and somewhat lower on wider drills. The average sugar content of the roots was practically the same when grown on drills of slightly different widths.

Bolting and Forking.

In 1930 the tendency of the beet crop to produce "bolters" was about normal. As usual, bolting was most prevalent in the case of crops which were sown early. The Kuhn (P) variety produced the fewest number of

bolted plants, but in 1930, as in 1929, this variety showed a greater tendency to bolt than was evident in previous seasons. Each of the three strains of the Kleinwanzleben variety produced approximately the same percentage of bolted plants. In the manurial trials the average percentages of bolted plants on the different sub-plots at all centres were almost equal.

In nearly all cases the shape of the roots was satisfactory, but at a number of centres a rather large proportion was forked. The application of 12 tons of well-rotted farmyard manure per acre in the drills immediately before sowing did not result in the production of an undue proportion of forked roots, and the records of the experiments afford little indication as to the cause of forking.

Pests and Diseases.

The crop at almost all centres was remarkably free from attack by insects and other pests. The yield was not materially affected by mangel fly at any centre, but at one centre the crop was patchy as a result of the destruction caused by springtails. The moist season did not favour the development of crown rot, and the crops at only two centres were attacked, very slightly, by this disease. Similarly, the disease known as leaf brown or yellow leaf, was not nearly so prevalent as in the preceding dry season. On the other hand, leaf spot or cercospora was much more prevalent than usual, probably as a result of the abnormally wet weather during the latter half of the growing season.

Although patchiness in the beet crop may be due to causes other than the attacks of pests and disease, it may be noted at this point, that out of a total of 69 centres the crop was reported as patchy at 15 centres, and the average yield on these plots was approximately 3 tons below that on the remaining plots where the stand of plants was regular.

II.—EXPERIMENTS AT THE DEPARTMENT'S FARMS AND AT THE ALBERT AGRICULTURAL COLLEGE (UNIVERSITY COLLEGE, DUBLIN).

During the season of 1930 experiments with sugar beet were conducted at the Department's farms at Athenry, Ballyhaise, and Clonakilty and also at the Albert Agricultural College, Glasnevin. These experiments comprised variety tests and, in addition, a series of trials arranged to determine the effects of :—

(1) The application of burnt lime in winter.

(2) The application of nitrate of soda in drills at time of sowing and as a top-dressing after singling.

(3) Singling the crops at different stages of growth.

A uniform procedure was adopted in laying down the experiments at the different centres except that only the variety and liming trials were carried out at the Glasnevin centre. A plot measuring one statute acre was reserved for variety and liming trials, and another plot of quarter this size was set aside at each of the farms at Athenry, Ballyhaise and Clonakilty for cultivation tests and trials with artificial manures. The two plots were dressed uniformly with well rotted farmyard manure applied at the rate of 15 tons per statute acre. The plot intended for variety trials was divided into two equal portions. by a line parallel to the longer dimension, and one half was dressed with burnt lime at the rate of 30 cwts. per statute acre before the land was ploughed in winter. In preparing the land for the sowing of the seed in the variety trials the drills were made across both sub-divisions of the one acre plot. On the adjoining quarter acre plot the other tests, as previously described, were carried out with seed of the Kuhn (P) variety.

Trials with Varieties and Lime.

The one acre plot at each centre reserved for variety trials, half of which had received a dressing of burnt lime in winter, was sown with twelve varieties and strains of seed, *viz.* :—Kuhn (P), Kleinwanzleben (N), Kleinwanzleben (Z), Kleinwanzleben (E), Schreiber (SKW), Schreiber (SO), Schreiber (SS), Buszczynski (NP), Buszczynski (P), Garton (A), Johnson's (Perfection), and Marsters' (Hilleshog), particulars of which are shown in Table I. A dressing of 4 cwt. superphosphate (35 per cent.), 4 cwt. kainit and 1 cwt. sulphate of ammonia per statute acre was applied at each centre to the entire plot at the time of sowing. At all centres the drills were 21 inches in width, and the seed was dibbled in by hand to allow exactly 9 inches between the plants when singled. At each centre 12 drills were sown with each of the eight varieties of seed.

The general cultivation, weighing, sampling and analysis of the crop on these plots were the same as in the case of the variety trials carried out by the Agricultural Instructors already described in this report. At every centre the seed germinated evenly and the crops on all of the plots produced a regular growth. The plants suffered no injury from pests or diseases, but in the latter half of the growing season, growth was retarded at the Ballyhaise centre owing to the effects of the wet season on the rather retentive soil at this centre. At none of the centres was any apparent difference noted, during the growing season, between the crops on the limed and unlimed plots.

Particulars as to the yield and sugar content of the beet on the various sub-plots at each centre which received the dressing of lime and on the corresponding sub-plots to which no lime was applied are shown in Tables VII and VIII respectively. Averages of the returns in respect of the variety trials and liming trials are shown in Table IX and Table X, respectively.

TABLE No. VII.

Returns from Plots to which Lime was Applied.

Variety	Yield per Statute Acre				Sugar Content of Roots				Average yield	Average Sugar Content
	Athenry	Bally-haise	Clona-kilty	Glas-nevin	Athenry	Bally-haise	Clona-kilty	Glas-nevin		
	T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
Kuhn (P)	11 7	7 3	16 14	12 6	18·0	17·8	19·2	17·0	11 18	18·0
Kleinwanzleben (N) ...	12 8	8 1	17 9	14 0	18·0	18·4	18·0	17·1	13 0	17·9
Kleinwanzleben (Z) ...	10 17	8 3	16 0	13 14	17·5	18·0	18·0	16·3	12 4	17·5
Kleinwanzleben (E) ...	14 8	8 3	18 ·0	14 6	16·7	17·0	18·1	16·3	13 14	17·0
Schreiber (SKW) ...	12 8	9 2	15 9	14 6	18·0	18·1	18·0	15·1	12 16	17·3
Schreiber (SO) ...	10 0	8 0	14 12	12 0	18·2	16·5	17·4	18·0	11 3	17·5
Schreiber (SS) ...	12 2	6 3	14 14	12 6	17·3	17·5	17·0	16·8	11 6	17·2
Buszczynski (NP) ...	11 11	9 0	18 0	12 3	16·6	17·7	16·6	15·2	12 14	16·5
Buszczynski (P) ...	11 11	8 0	13 12	12 6	17·5	17·6	18·3	16·2	11 7	17·4
Garton (A)	11 2	8 3	16 0	11 17	17·1	17·5	17·6	14·4	11 16	16·7
Johnson's (Perfection)	12 14	8 2	17 6	14 7	17·8	19·0	17·3	15·7	13 2	17·5
Marsters (Hilleshog) ...	13 0	7 1	17 6	16 3	18·3	19·1	17·0	16·6	13 8	17·8

TABLE No. VIII.

Returns from Plots to which no Lime was Applied.

Variety	Yield per Statute Acre				Sugar Content of Roots				Average yield	Average Sugar Content
	Athenry	Bally-haise	Clona-kilty	Glas-nevin	Athenry	Bally-haise	Clona-kilty	Glas-nevin		
	T. C.	T. C.	T. C.	T. C.	%	%	%	%	T. C.	%
Kuhn (P)	11 5	8 0	15 9	14 7	17·7	18·1	18·1	17·7	12 5	17·9
Kleinwanzleben (N) ...	12 2	8 2	17 0	15 14	17·7	17·6	17·1	16·7	13 5	17·3
Kleinwanzleben (Z) ...	8 19	8 2	14 14	12 0	18·0	19·4	17·0	16·5	10 19	17·7
Kleinwanzleben (E) ...	11 17	8 3	16 6	14 11	17·4	17·0	16·3	17·2	12 14	17·0
Schreiber (SKW) ...	9 5	8 0	13 17	14 6	17·5	17·6	18·0	16·6	11 7	17·4
Schreiber (SO) ...	9 14	7 3	13 17	14 0	18·3	18·3	16·4	17·5	11 4	17·6
Schreiber (SS) ...	10 2	7 2	14 6	13 17	18·1	17·4	18·0	17·3	11 7	17·7
Buszczynski (NP) ...	12 5	7 0	16 12	18 0	17·4	17·3	18·6	15·4	13 9	17·2
Buszczynski (P) ...	9 5	8 1	14 0	13 7	17·5	18·0	18·5	16·8	11 3	17·7
Garton (A)	11 5	7 3	15 6	15 7	17·4	17·0	17·0	16·3	12 5	16·9
Johnson's (Perfection)	11 5	5 2	17 17	17 14	18·1	17·2	17·7	17·0	13 0	17·5
Marsters (Hilleshog) ...	11 17	6 0	17 17	17 0	18·4	18·2	17·7	17·1	13 4	17·9

TABLE No. IX.

AVERAGES OF THE RETURNS FROM THE VARIETY TRIALS SHOWN IN TABLES VII AND VIII.

VARIETY OF STRAIN	Average Yield of Roots per statute acre (net factory weight)	Average Sugar Content of Roots	Average Weight of Sugar per statute acre
	Tons	per cent.	Tons
Kuhn (P)	12·08	17·95	2·17
Kleinwanzleben (N)	13·13	17·60	2·31
Kleinwanzleben (Z)	11·58	17·60	2·04
Kleinwanzleben (E)	13·20	17·00	2·24
Schreiber (SKW)	12·08	17·35	2·10
Schreiber (SO)	11·18	17·55	1·96
Schreiber (SS)	11·33	17·45	1·98
Buszczynski (NP)	13·08	16·85	2·20
Buszczynski (P)	11·25	17·55	1·97
Garton (A)	12·03	16·80	2·02
Johnson (Perfection) ...	13·05	17·50	2·28
Marsters (Hilleshog)	13·30	17·85	2·37

TABLE No. X.

AVERAGES OF THE RETURNS FROM THE LIMING TRIALS SHOWN IN TABLES VII. AND VIII.

CENTRE.	Hydrogen-ion Concentration of soil and sub-soil.	Yield per Statute Acre (factory weight).				Sugar Content of Roots (per cent.).		Weight of Sugar (per acre).	
	NO Lime.	Lime.		NO Lime.		Lime.	NO Lime.	Lime.	NO Lime.
	PH.	T.	C.	T.	C.	per cent.	per cent.	Tons.	Tons.
Ballyhaise ...	5·0	7	18	7	6	17·8	17·9	1·41	1·31
Clonakilty ...	6·5	16	5	15	12	17·7	17·5	2·88	2·73
Athenry ...	7·6	11	19	10	15	17·6	17·8	2·10	1·91
Glasnevin ...	7·9	13	6	15	0	16·2	16·8	2·15	2·52

With reference to the average returns from the variety trials as shown in Table IX. it should be noted that one of the objects of these trials was to compare the results obtained from different strains of seed belonging to the three principal types of sugar beet as distinguished by the yield of roots and the percentage of sugar in them. Growers of beet seed on the Continent usually designate the type of each of their strains of seed by means of an initial letter, and the varieties or strains included in these trials may, accordingly, be grouped as follows :—

(*a*) The type selected specially for the production of roots of high sugar content rather than heavy yield is represented by Group I, namely—Kleinwanzleben (Z) and Schreiber (SO).

(*b*) The type which produces a very heavy yield of roots containing a relatively low percentage of sugar is represented by Group II, namely—Kleinwanzleben (E), Buszczynski (NP) and Schreiber (SKW).

(*c*) The type which is intermediate between the two preceding types is represented by Group III, namely—Kleinwanzleben (N), Kuhn (P), Schreiber (SS) and Buszczynski (P).

The three strains of English-grown seed, if judged by their performance in these trials, may be compared with the other varieties by including Garton (A) in Group II and Johnson's (Perfection) and Marsters (Hilleshog) in Group III.

Of the two varieties in Group I, Kleinwanzleben (Z) produced a slightly higher yield per acre of roots and sugar. Of the four varieties in Group II, Kleinwanzleben (E) produced the highest yield of roots and sugar, but was inferior to Schreiber (SKW) as regards the percentage of sugar in roots. Garton (A) was somewhat inferior to the other three varieties as regards yield and sugar content. In Group III, Marsters (Hilleshog) produced the highest yield of roots and sugar, followed closely in the order named by Kleinwanzleben (N), Johnson's (Perfection) and Kuhn (P). The varieties Schreiber (SS) and Buszczynski (P) were inferior to the other varieties in this group, and compared more closely with the two varieties in Group I. Comparisons of the varieties which gave superior returns in the different groups show that whilst Kuhn (P) produced a slightly higher average sugar content than any other variety, the highest average yield of roots and sugar was produced by the Marsters (Hilleshog) variety, followed in order by Kleinwanzleben (N) and Johnson's (Perfection), all of which are in Group III. As compared with the four leading varieties in Group III, Kleinwanzleben (E), the superior variety in Group II, was somewhat inferior as regards sugar content, and Kleinwanzleben (Z), the better variety in Group I, produced a lower yield of roots, having a sugar content which was no better, than that of the three leading varieties in Group III.

The average returns from the liming trials at the four centres (Table X) show that at all except the Glasnevin centre the average yields of roots and sugar were better on the limed plots than on the plots which received no lime. At the Glasnevin centre not only the average yield but the average sugar content was considerably lower on the limed plots whereas there was very little difference in the sugar content of the beet on the limed and unlimed plots at each of the other centres.

The results obtained in similar trials with lime carried out at these four centres in 1929 are confirmed by the results obtained in 1930, except at the Athenry centre, where in the former year the lime dressing had practically no effect on the yield and sugar content of the crop.

Nitrate of Soda Applied in Drills at Time of Sowing and as a Top-dressing.

With the object of comparing the effects of nitrate of soda, when applied in the drill at the time the sugar beet seed is sown and when applied as a top-dressing immediately after the crop is singled, a series of plots was laid down at the Athenry, Ballyhaise and Clonakilty centres. This series of plots was also designed to afford a comparison of the values of sulphate of ammonia and nitrate of soda when used for sugar beet along with superphosphate and kainit. The land was prepared for these trials in the same manner as the adjoining variety plot which received no lime. Each sub-plot comprised five drills and as regards cultivation all sub-plots were, of course, treated in identical manner. During the growing season no important difference was observed in the general appearance of the plants on the different plots. The returns from the plots at each centre are shown in Table XI.

TABLE XI.

TABLE No. XI.

Artificial Manures Applied per Statute Acre	Yield per Statute Acre (Factory Weight)			Sugar Content of Roots			Average	
	Athenry	Bally-haise	Clona-kilty	Athenry	Bally-haise	Clona-kilty	Yield (Factory Weight)	Sugar Content
	T. C.	T. C.	T. C.	%	%	%	T. C.	%
I. 4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied in the drills at time of sowing.	10 5	7 2	15 4	18·1	17·0	18·1	10 17	17·7
II. 4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied as a top-dressing after singling.	10 17	8	15 0	17·2	17·2	19·0	10 15	17·8
III. 4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 1 cwt. Sulphate of Ammonia applied in the drills at time of sowing.	11 0	6 0	15 14	16·5	17·5	18·5	10 18	17·5
IV. 4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 149 lb. Nitrate of Soda applied in the drills at time of sowing.	12 5	7 0	15 9	16·0	17·0	18·1	11 11	17·0
V. 4 cwt. Superphosphate 35% applied in the drills at time of sowing. 4 cwt. Kainit applied in the drills at time of sowing. 149 lb. Nitrate of Soda applied in the drills at time of sowing. 1 cwt. Nitrate of Soda applied as a top-dressing after singling.	*	7 10	16 3	*	17·0	18·0	11 16	17·5

* Through misadventure no returns could be obtained from this sub-plot.

A comparison of the average yields and sugar contents of the crops grown on Plots I and II indicates that there was practically no difference in the effects of nitrate of soda when applied in the drill at the time the sugar beet seed is sown and when applied as a top-dressing immediately after the crop is singled. The relative values of sulphate of ammonia and nitrate of soda, when used for sugar beet along with superphosphate and kainit, are indicated by comparisons of the returns from Plots I and II with the corresponding returns from Plots IV and V, respectively. The crops on Plots I and II, to which sulphate of ammonia was applied at the rate of one cwt. per statute acre, produced lower yields of roots containing higher percentages of sugar than were obtained from the crops on Plots IV and V that were dressed with manurial mixtures in which sulphate of ammonia was replaced by sufficient nitrate of soda to supply the same quantity of nitrogen. Similar results are shown by a comparison of the returns from Plots III and IV.

Singling at Different Stages of Growth.

Plots on which the plants were singled at the stage when they had developed two rough leaves and four rough leaves, respectively, were again laid down at each centre. Save that these plots were singled at different stages of growth they received exactly the same treatment.

The results in regard to yield and sugar content are shown in Table XII.

TABLE No. XII.

Centre.	Yield per Statute Acre (Factory Weight).		Sugar Content of Roots.	
	Plants singled at two-leaf stage	Plants singled at four-leaf stage	Plants singled at two-leaf stage	Plants singled at four-leaf stage
	T. C.	T. C.	%	%
Athenry	11 8	9 9	18·3	18·0
Ballyhaise	6 5	7 0	17·4	17·1
Clonakilty...	16 12	15 9	18·6	18·0
Average	11 8	10 13	18·1	17·7

It will be observed that, on the average, the yields and sugar contents of the crops singled when only two rough leaves had developed were better than the corresponding returns from those crops singled when four rough leaves had grown.

SUMMARY OF THE RESULTS OF THE PRINCIPAL EXPERIMENTS WITH SUGAR BEET CONDUCTED IN THE YEAR 1930.

(1) In the variety experiments conducted by the Agricultural Instructors the average returns from the Kuhn (P) and Kleinwanzleben (Z) varieties confirm the results of similar trials conducted by the Instructors during the five preceding seasons, namely—that these varieties are equal in sugar content but that Kuhn (P) is somewhat superior in yield and resistance to bolting. The three strains of the Kleinwanzleben variety were true to type. On the average the heaviest yield of roots was produced by the (E) strain and the roots of the (Z) strain contained the highest percentage of sugar, but the intermediate (N) strain was only slightly below the (E) strain as regards yield, and nearly equal to the (Z) strain in sugar content of roots.

(2) In the manurial trials conducted by the Agricultural Instructors the standard dressing of artificial manures consisting of 4 cwt. superphosphate (35%), 4 cwt. kainit, and 1 cwt. sulphate of ammonia per

statute acre, applied immediately before sowing the sugar beet seed, gave quite satisfactory returns as compared with the results obtained from certain modifications of this dressing; but the application of additional quantities amounting to 25 per cent. and 50 per cent. of the standard dressing, gave profitable increases in the average value of the crop per acre.

SUMMARY OF THE RESULTS OF EXPERIMENTS WITH SUGAR BEET WHICH WERE CONCLUDED IN THE YEAR 1930.

(1) In trials conducted at the Department's Farms during three seasons there was practically no difference in the effects of nitrate of soda when applied in the drill at the time of sowing and when applied as a top-dressing immediately after the crop is singled. There was, also, no difference in the average yield and sugar content of the crop when nitrogen in the form of nitrate of soda was used to replace an equivalent quantity of sulphate of ammonia in the dressings usually applied to the beet crop in this country.

(2) On soils deficient in lime, increased returns were obtained where a dressing of burnt lime, at the rate of 30 cwt. per statute acre, was applied in the winter preceding the sowing of the crop.

(3) The average results of trials conducted during five seasons show that the yield and sugar content of the crop were very slightly affected by singling the plants at different stages of growth, namely—when the plants had developed two rough leaves and when four rough leaves had grown.

EGG-LAYING COMPETITION, 1929-30.

The Eighteenth Egg-Laying Competition, conducted by the Department of Agriculture, was held at the Munster Institute, Cork, during a period of 48 weeks beginning on the 16th October, 1929 and ending on the 16th September, 1930. The entries for the Competition were considerably in excess of the accommodation available. A total of 98 pens of pullets of various breeds was accepted, as well as 15 pens of ducks. The number of birds in a pen was six in the case of pullets and four in the case of ducks.

The system introduced in the 1926-27 Competition, whereby persons holding Egg Distributing Stations under County Committees of Agriculture were permitted to compete with the same pen in an open Section as well as in a Section confined to Station holders, was discontinued. Station holders were, however, allowed to enter a second pen in one of the open Sections on payment of the requisite entry fee.

The Competition for pullets was arranged in Sections as follows :—

Section I.—Any non-sitting breed	9	pens
Section II.—White Wyandotte	24	,,
Section III.—Any sitting breed other than White Wyandotte	16	,,
Section IV.—Any non-sitting breed (confined to holders of Egg Distribution Stations—hen and duck—in the Irish Free State in 1930)	13	,,
Section V.—White Wyandotte (confined to holders of Egg Distribution Stations—hen and duck—in the Irish Free State in 1930)	12	,,
Section VI.—Any sitting breed other than White Wyandotte (confined to holders of Egg Distribution Stations—hen and duck—in the Irish Free State in 1930)	24	,,

Quality of Birds.

The clause introduced in the regulations in 1928-29 making it conditional that birds should be of the prescribed minimum weight on arrival at the Munster Institute, was more rigidly enforced. The greater number of the birds arrived at the Test in good condition, and showed a noticeable improvement in type and breed characteristics, the majority being up to standard weight requirements. There is, however, a still further need for improvement, as a number of the pullets were immature and in poor condition and, as a result, failed to reach the prescribed minimum weights.

Eggs were graded as follows :—

Egg Grades.

Special grade—$2\frac{1}{4}$ ozs. and over throughout the period of the Competition.

First grade—$1\frac{7}{8}$ ozs. for the first four weeks (16th October to 12th November, inclusive).

$1\frac{15}{16}$ozs. for the second four weeks (13th November to 10th December, inclusive).

2 ozs. during the remainder of the competition.

Second grade—Eggs which were not more than $\frac{1}{4}$ oz. less than the weight prescribed for first grade eggs in the same period.

Eggs which weighed less than the weight prescribed for second grade eggs were recorded separately ; but were not included in the score total on which awards were based.

Special and first grade eggs were included in the one category for the purpose of awarding prizes.

Egg Production.

The general standard of egg production was good ; but far too many of the pens failed in the matter of size, thus reducing the proportion of first grade eggs. While some very good individual scores were recorded, no outstanding high pen records were reached. This may be due to the fact that pens holding leading positions in the earlier stages of the Test were handicapped owing to mortality. A total of 103 birds laid 200 first grade eggs or over, and not more than 20 per cent second grade, as compared with 177 in the previous Test.

It is again necessary to draw attention to the high percentage of second grade eggs produced in each section. The fact that some of the birds were barely up to the minimum weight prescribed and were, moreover, in poor condition on arrival at the Test was, doubtless, partly responsible for the heavy production of second grade eggs. As many birds which in appearance, etc., were quite satisfactory, also produced large numbers of second grade eggs, and as the small egg factor is undoubtedly hereditary, it can only be assumed that size of egg does not, in all cases, receive due consideration in the selection of breeding stock. Good body weight, stamina, and capacity to produce fair sized eggs, are more important than capacity to produce large number of eggs, and breeders who select their birds accordingly will have no cause for regret.

Making no allowance for deaths during the Test, the average number of eggs per pullet was 171·3. The average number of eggs per pullet for which a record for the full 48-week period was available, was 189·7. Two pullets, a White Leghorn and a White Wyandotte, did not lay during the Test.

The Twenty Per Cent Clause. The Clause introduced in 1926-27 prescribing a limit of twenty per cent for second grade eggs was retained. The total number of pens disqualified under this Clause was 39. Had the original Clause, which was in operation up to 1927-28 and which prescribed a limit of 300 second grade eggs, remained in force the number of pens disqualified would be 26.

Mortality. A total of 85 birds died during the competition representing 14·4 per cent as compared with 10 per cent in the previous one. A number of the death swere due to causes common among birds in high production.

In about 45 per cent of the cases, however, post-mortem examinations revealed the presence of visceral gout. Full details will be found on Table VI.

Feeding. The feeding of the birds was similar to that used in the previous Test, with the exception that a 2 per cent mineral mixture was included in the mash. The foods were generally made up (by weight) according to the following formulae for both dry and wet mash :—

4	Parts of	Pollard.
2	,,	Bran.
2	,,	Maize Meal.
1	,,	Sussex Ground Oats.
1	,,	Fish Meal.

The grain mixture usually consisted of equal parts of wheat or oats and cracked maize. The proportion of maize varied according to season and weather conditions. The following quantities of foods were used :—

Pullets.		Ducks.	
Mixed Meals ...	28,252 lbs.	Mixed Meals ...	4,810 lbs.
Oats	9,632 ,,	Oats	834 ,,
Cracked Maize ...	17,808 ,,	Cracked Maize ...	1,892 ,,
Wheat	392 ,,	Wheat	56 ,,
Mineral Mixture ...	480 ,,	Grit and Shell ...	712 ,,
Grit and Shell ...	3,388 ,,		

Vegetables fed in addition.

Duck Section. In this Section fifteen pens competed, viz :—five of Khaki Campbell, eight of Fawn and White Runner, and two of White Runner. The birds on arrival at Test appeared to be well chosen generally ; but immaturity among some of the pens was very marked. As a result the first few weeks had to be devoted in endeavouring to bring the birds up to the required laying standard.

The proportionately large number of second grade eggs, and eggs under the prescribed weight for second grade, were mainly due to the minimum weights for both first and second grade eggs having been increased by ¼ oz. over those in force for the previous Test.

Thirteen pens were disqualified for producing more that 15 per cent of second grade eggs; but a marked improvement in the size of egg was noted during the latter stages of the Test.

Breeders should pay greater attention to the selection of ducks for stock and, as in the case of hens, to eliminate from the breeding pens birds deficient in body size irrespective of their high egg yield.

The winning pen (No. 120), which led from the start, is worthy of special mention from the point of view of egg size, the total score being 937 with only 10 second grade eggs.

TABLE I.

The following Table shows the number of pullets competing, the number of eggs laid, cost of food, return for eggs and gross profit for each of the eighteen competitions held since 1912/13:—

Eleven months ending	No. of Pullets	No. of Eggs Laid	Average Number per Bird	Average Value per Bird	Cost of Food per Bird	Average Price of Eggs per doz.	Return per Bird over Cost of Food
				s. d.	s. d.	d.	s. d.
31st Aug. 1913	318	38,199	120·1	11 2·8	5 8	13·05	5 6·8
,, 1914	282	39,216	139·0	13 3·6	5 8·3	13·77	7 7·3
,, 1915	264	39,764	150·6	17 6	7 0·5	16·75	10 5·5
,, 1916	294	49,830	169·5	23 0·5	8 11·8	19·58	14 0·7
,, 1917	210	36,660	174·6	32 7·2	13 10·7	26·89	18 8·5
,, 1918	210	36,106	171·9	47 4	16 6	39·66	30 10·1
,, 1919	306	55,124	180·0	53 3·4	20 0	42·59	33 3·4
,, 1920	354	65,840	185·98	53 9	19 3·9	41·62	34 5·2
,, 1921	288	51,584	179·0	40 9·5	18 7·3	32·79	22 2·2
9th Sept., 1922	342	63,518	185·72	33 8·8	11 10	26·15	21 10
16th ,, 1923	198	38,519	194·5	27 11·5	12 1	20·75	15 10·5
15th ,, 1924	342	61,144	178·78	26 6·5	11 1·5	21·37	15 5
15th ,, 1925	348	63,755	183·2	27 4·9	10 5·2	22·58	16 11·7
15th ,, 1926	342	65,137	190·4	28 6·1	10 7·8	21·5	17 10·3
16th ,, 1927	492	93,912	190·88	26 10·7	9 3·6	20·3	17 7·1
16th ,, 1928	510	95,226	186·7	24 10·9	10 8	19·2	14 2·9
16th ,, 1929	540	101,820	188·6	28 8·5	11 0·5	21·9	17 8
16th ,, 1930	588	100,752	171·3	24 4·2	8 5·8	20·5	15 10·4

It should be noted that the figures given in the above table are based on the total number of pullets competing, no allowance having been made in respect of deaths during the test.

Taking the birds which died during the 1929–30 Test into account only up to the date of death, the average number of pullets for the whole period was 538·9 and the average number of eggs per bird 187. On this basis, the average egg value per bird was £1 6s. 6·8d., the cost of food per bird was 9s. 3d., and the return per bird over cost of food 17s. 3·8d.

On Tables III. and IV. pullets which died during the competition have been eliminated from the calculations and true averages for the remaining birds are given.

TABLE II.

Number and Percentage of pullets of each Breed which laid 200 First Grade Eggs and over, and not more than 20 per cent Second Grade.

Breed.	Total Number of Pullets	Number of Pullets which laid 200 First Grade Eggs and over	Percentage of Pullets laying 200 First Grade Eggs and over.
			Per cent.
White Wyandotte ...	186	42	22·6
White Leghorn ...	101	22	21·8
Rhode Island Red ...	126	19	15·1
Buff Rock ...	40	10	25·0
Barred Rock ...	15	5	33·3
Light Sussex ...	22	—	—
Black Minorca ...	9	5	55·5
Australorp ...	4	—	—
	503	103	20·5

TABLE III.

Average Egg Yield from each Breed.

Breed.	Number of Pullets	Number of Eggs Laid	Average Number of Eggs Per Pullet	Average Number of First Grade Eggs Per Pullet	Average Number of Second Grade Eggs Per Pullet
White Wyandotte ...	186	36,414	195·8	152·8	43·0
Rhode Island Red ...	126	23,148	183·7	149·7	34·0
White Leghorn ...	101	19,431	192·4	152·8	39·6
Buff Rock	40	7,434	185·8	165·2	20·6
Light Sussex ...	22	3,574	162·4	130·6	31·8
Barred Rock ...	15	2,932	195·4	160·3	35·1
Black Minorca ...	9	1,758	195·3	190·5	4·8
Australorp ...	4	741	185·2	159·7	25·5
	503	95,432	189·7	153·0	36·7

Table IV.

Average number of First Grade Eggs Per Pullet, during the period 16th October to 15th January.

Breed		Number of Pullets	Total Number of First Grade Eggs	Average Number of First Grade Eggs Per Pullet.
White Wyandotte	...	206	6,632	32·2
Rhode Island Red	...	140	3,928	28·0
White Leghorn	...	114	2,568	22·5
Buff Rock ...	...	42	1,493	35·5
Light Sussex	...	23	648	28·2
Barred Rock ...	...	17	352	20·7
Black Minorca	...	12	434	36·2
Australorp ...	...	6	184	30·7
		560	16,239	29·0

DUCK SECTION.

Table V.

Average Return from each Breed.

Breed.		Number of Ducks.	Number of Eggs Laid.	Average Number of Eggs Per Duck.	Average Number of First Grade Eggs Per Duck.	Average Number of Second Grade Eggs Per Duck.
Indian Runner	...	29	5,041	173·8	120·6	53·2
Khaki Campbell	...	28	4,408	157·4	78·7	78·7
		57	9,449	165·7	100·0	65·7

TABLE VI.

The following Table gives the number of pullets that died during the Test, and the Cause of death in each case :—

Date of Death.	Number of Pullet.	Number of Pen.	BREED.	Cause of Death.
1929.				
Oct. 30	458	77	White Wyandotte	Acute peritonitis and inflammation of the oviduct.
Nov. 12	393	66	White Leghorn ...	Leukaemia, a disease of the blood.
,, 19	181	31	White Wyandotte	Rupture of the ovary.
,, 19	264	44	Rhode Island Red	Impaction of the gizzard.
,, 25	188	32	White Wyandotte	Inflammation of the intestines. Also affected with visceral gout.
,, 25	103	18	White Wyandotte	Inflammation of the intestines.
,, 25	218	37	White Wyandotte	Inflammation of the intestines.
,, 25	298	50	Rhode Island Red	Inflammation of the intestines. Also affected with visceral gout.
,, 26	236	40	Rhode Island Red	Inflammation of the intestines.
,, 26	238	40	Rhode Island Red	Inflammation of the intestines.
,, 26	441	74	White Wyandotte	Inflammation of the intestines. Also affected with visceral gout.
,, 28	240	40	Rhode Island Red	Inflammation of the intestines. Also affected with visceral gout.
,, 29	108	18	White Wyandotte	Inflammation of the intestines. Also affected with visceral gout.
,, 30	684	114	Barred Rock ...	Acute enteritis and visceral gout.
Dec. 3	422	71	White Leghorn ...	Enteritis and visceral gout.
,, 3	340	57	Rhode Island Red	Enteritis and visceral gout.
,, 6	342	57	Rhode Island Red	Acute inflammation of the intestines and visceral gout.
,, 7	339	57	Rhode Island Red	Acute inflammation of the intestines and visceral gout.
,, 9	150	25	White Wyandotte	Acute inflammation of the intestines and visceral gout.
,, 10	311	52	Rhode Island Red	A gouty condition of the kidneys and congestion of the mucous membrane of the intestines.
,, 16	65	11	White Leghorn ...	Inflammation of the intestines and deposit of urates in the kidneys.
,, 16	66	11	White Leghorn ...	Inflammation of the intestines and deposit of urates in the kidneys.
,, 22	139	24	White Wyandotte	Acute peritonitis and inflammation of the oviduct.
,, 22	168	28	White Wyandotte	Visceral gout and inflammation of the intestines.
,, 30	52	9	White Leghorn ...	Leukaemia, a disease of the blood.
1930				
Jan. 8	623	104	Light Sussex ...	Tuberculosis.
,, 9	606	101	Rhode Island Red	Piritonites and visceral gout.
,, 11	32	6	White Leghorn ...	Fracture of the cranium caused by being caught in trap-nest.
,, 17	380	64	White Leghorn ...	Inflammation of the intestines and visceral gout.
,, 20	211	36	White Wyandotte	Acute peritonitis and inflammation of the cloaca.
,, 20	631	106	Buff Rock ...	Acute peritonitis and inflammation of the cloaca.
,, 20	384	64	White Leghorn ...	Visceral gout and inflammation of the intestines.
,, 22	430	72	Black Minorca ...	Enteritis. The gizzard was flabby.
,, 22	135	23	White Wyandotte	Flabby condition of wall of gizzard.

TABLE VI.—continued.

Date of Death.	Number of Pullet.	Number of Pen.	Breed.	Cause of Death.
1930.				
Jan. 23	448	75	White Wyandotte	Enteritis and visceral gout.
,, 24	432	72	Black Minorca ...	Enteritis and visceral gout.
,, 25	394	66	White Leghorn ...	Inflammation of the intestines and visceral gout.
,, 30	74	13	Black Minorca ...	Visceral gout and enteritis.
,, 31	93	16	White Wyandotte	Acute peritonitis and the mucous membrane in the anterior portion of the bowel was acutely congested.
,, 31	751	131	Australorp ...	Enteritis and changes in the kidneys.
,, 31	752	131	Australorp ...	Enteritis and visceral gout.
Feb. 11	309	52	Rhode Island Red	Impaction of the gizzard. There was also evidence of visceral gout.
,, 11	312	52	Rhode Island Red	Impaction, of the gizzard. Three was also evidence of visceral gout.
,, 11	675	113	Barred Rock ...	Impaction of the gizzard.
,, 12	434	73	White Wyandotte	Acute peritonitis following upon the rupture of an egg in the oviduct.
Mar. 12	299	50	Rhode Island Red	Haemorrhage from the liver and tuberculosis.
,, 12	303	51	Rhode Island Red	Acute enteritis.
,, 14	409	69	White Leghorn ...	Enteritis.
,, 18	354	59	White Leghorn ...	Enteritis.
,, 18	479	80	White Wyandotte	The only change observed was an inflammation of the crop and oesophagus.
18	540	90	Rhode Island Red	Inflammation of the cloaca probably following upon an injury during egg-laying.
,, 21	117	20	White Wyandotte	Visceral gout and enteritis.
,, 22	289	49	Rhode Island Red	Tuberculosis and enteritis.
,, 24	230	39	Rhode Island Red	Acute peritonitis.
,, 24	81	14	White Wyandotte	Haemorrhage from the liver.
,, 29	120	20	White Wyandotte	Visceral gout.
,, 31	107	18	White Wyandotte	Pericarditis and peritonitis.
April 8	482	81	White Wyandotte	Tuberculosis.
,, 9	1	1	White Leghorn ...	Large tumour of the ovary.
,, 14	610	102	Rhode Island Red	Tuberculosis.
,, 17	254	43	Rhode Island Red	Tuberculosis.
,, 17	758	132	Rhode Island Red	Tuberculosis.
,, 22	14	3	White Leghorn ...	Lascerated oviduct.
,, 23	49	9	White Leghorn ...	Peritonitis.
,, 28	35	6	White Leghorn ...	Enteritis.
,, 30	208	35	White Wyandotte	Acute peritonitis.
May 22	495	83	White Wyondotte	Rupture of the liver.
,, 31	270	45	Rhode Island Red	Tuberculosis.
June 4	97	17	White Wyondotte	Acute peritonitis.
,, 10	682	114	Barred Rock ...	Visceral gout and enteritis.
,, 24	101	17	White Wyondotte	Inflammation of the oviduct.
,, 24	391	66	White Leghorn ...	Leukaemia.
July 3	28	5	White Leghorn ...	Enteritis and evidence of gout.
,, 6	450	75	White Wyondotte	Sarcomata involving ovary and peritoneum.
,, 8	445	75	White Wyandotte	Fatty infiltration of liver with dilation of heart.
Aug. 8	396	66	White Leghorn ...	Visceral gout.
,, 13	233	39	Rhode Island Red	Peritonitis and inflammation of oviduct.
,, 16	269	45	Rhode Island Red	Tuberculosis.

TABLE VI.—continued.

Date of Death.	No. of Pullet.	No. of Pen.	Breed.	Cause of Death.
1930.				
,, 23	616	103	Light Sussex ...	Intestine ulcerated.
,, 23	663	111	Buff Rock ...	Peritonitis following inflammation of the oviduct.
,, 30	611	102	Rhode Island Red	Peritonitis and chronic inflammation of the oviduct.
Sept. 2	124	21	White Wyandotte	Haemorrhage from the liver.
,, 4	360	60	White Leghorn ...	Bacillary White Diarrhoea.
,, 8	209	35	White Wyandotte	Peritonitis and inflammation of the oviduct.
,, 15	147	25	White Wyandotte	Internal haemorrhage from a fatty liver.

DUCKS.

Date of Death.	Number of Duck.	Number of Pen.	Breed.	Cause of Death.
1929.				
Dec. 8	715	122	Indian Runner ...	Affected with prolapse of the oviduct, and death was due to acute peritonitis.
1930				
May 27	698	118	Indian Runner ...	Seriously infected with tuberculosis.
Aug. 5	686	115	Indian Runner ...	Tuberculosis.

LIST OF PRIZEWINNERS.

Section I.—Non-Sitting Breeds.

Name and Address of Owner.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs	Value of Eggs	Average Number of Eggs Per Bird.
				£ s. d.	
First Prize. Mrs M. G. King, Beechgrove, Donadea, Co. Kildare.	White Leghorn	1,131	102	8 6 6¾	188·5
Second Prize. Mrs. E. MacDonald, Ardnacarrig, Bandon, Co. Cork.	White Leghorn	1,151	106	8 5 3¾	191·8
Third Prize. Miss E. Cavanagh, Kimmage Grove, Terenure, Dublin.	Black Minorca	1,036	41	7 11 3	172·7
Fourth Prize. * Rev. Bro. Fintan Bergin, Our Lady of Lourdes, Cahermoyle, Ardagh Co. Limerick.	White Leghorn	1,018	68	7 15 4¼	169·7

* The value of the eggs produced would have entitled this competitor to third prize, had he not been disqualified by being two eggs short of the required number. In the circumstances, and particularly because of the small number of second grade eggs, the Department have decided to award him the fourth prize for which no competitor in the Section fully qualified.

Section II.—White Wyandotte.

Name and Address of Owner.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs	Average Number of Eggs Per Bird.
First Prize.			£ s. d.	
Mrs. A. Hartland, Croughtamore, Cork.	1,262	51	9 10 2¾	210·3
Second Prize. Mrs. B. Deegan, Lodge Park, Freshford, Co. Kilkenny.	1,306	229	9 7 6½	217·7
Third Prize. Mrs. M. G. King, Beechgrove, Donadea, Co. Kildare.	1,224	72	9 4 8½	204·0
Fourth Prize. Mrs. E. MacDonald, Ardnacarrig, Bandon Co. Cork.	1,203	127	9 0 6¾	200·5

Section III.—Sitting Breeds (other than White Wyandotte).

Name and Address of Owner.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs.	Average Number of Eggs Per Bird
First Prize.				£ s. d.	
Miss S. Deane, Longraigue, Foulks Mills, Co. Wexford.	Buff Rock	1,290	209	8 15 9	215·0
Second Prize. Miss D. Strong, Moate House, Kells, Co. Meath.	Rhode Island Red	1,181	53	8 7 7¼	196·8
Third Prize. Miss P. White, Gortnafluir, Clonmel, Co. Tipperary.	Light Sussex	1,162	143	8 4 1½	193·7
Fourth Prize. Mr. C. F. Harvey, Duffcarrig, Gorey, Co. Wexford.	Rhode Island Red	1,071	156	7 9 8¾	178·5

Section IV.—Non-Sitting Breeds (Station-holders).

Name and Address of Owner.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs.	Average Number of Eggs Per Bird.
				£ s. d.	
First Prize. Mrs. M. Wallace, Camlin, Roscrea, Co. Tipperary.	White Leghorn	1,163	42	8 0 7¾	193·8
Second Prize. Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	White Leghorn	1,149	195	7 19 2¼	191·5
Third Prize. Miss M. O'Brien, Philipstown Cottage, Cappawhite, Co. Tipperary.	White Leghorn	1,119	183	7 14 7¾	186·5
Fourth Prize. Mrs. M. Kelleher, Shanakeil House, Kilcorney, Banteer, Co. Cork.	White Leghorn	1,135	135	7 11 7½	189·2

Section V.—White Wyandotte (Station-holders).

Name and Address of Owner.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs.	Average Number of Eggs Per Bird.
			£ s. d.	
First Prize. Mrs. M. Drohan, Ballynevin, Carrick-on-Suir, Co. Waterford.	1,188	83	9 1 4½	198·0
Second Prize. Miss K. Newman, Drinadaly, Trim, Co. Meath.	1,185	77	8 16 6¼	197·5
Third Prize. Miss A. Donegan, Monasterboice, Drogheda, Co. Louth.	1,038	34	7 17 0¼	173·0
Fourth Prize. Mrs. M. Hanrahan, Ardreigh, Urlingford, Co. Kilkenny.	1,125	75	7 15 10½	187·5

SECTION VI.—SITTING BREEDS (other than White Wyandotte).

STATION HOLDERS.

NAME AND ADDRESS OF OWNER.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs.	Average Number of Eggs Per Bird.
				£ s. d.	
First Prize. Mrs. E. A. Henderson, Ardrum, Inniscarra, Co. Cork.	Barred Rock	1,282	61	8 15 2	213·7
Second Prize. Mrs. M. Doyle, Coolmanagh Hacketstown, Co. Carlow.	Rhode Island Red	1,206	26	8 8 10¼	201·0
Third Prize. Sister-in-Charge, Technical School, Stradbally, Laoighis.	Buff Rock	1,093	118	8 2 7¼	182·2
Fourth Prize. Mrs. K. McCabe, Derry, Aughnamullen, Ballybay, Co. Monaghan.	Buff Rock	1,108	110	8 2 0¾	184·7

DUCK SECTION.

NAME AND ADDRESS OF OWNER.	Breed.	Total Number of Eggs Laid.	Number of Second Grade Eggs.	Value of Eggs	Average Number of Eggs Per Bird.
				£ s. d.	
First Prize. Miss D. Strong, Moate House, Kells, Co. Meath.	Indian Runner	937	10	6 9 1¼	234·2

The remaining competing pens failed to qualify for prizes.

The Special Prize of a silver medal (or its value £2) has also been awarded to Miss D. Strong, Moate House, Kells, Co. Meath, for Indian Runner Duck No. 705 which laid 283 eggs, value £1 19s. 3¾d.

SPECIAL PRIZES.

The Cup (or its value £10) for the *Pen* of pullets laying eggs of the highest market value during the Competition, has been awarded to Mrs. A. Hartland, Croughtamore, Cork, for the pen of White Wyandottes which also won first prize in Section II.

The special prize for the *Pen* of pullets (non-sitting breed) laying the highest average of first grade eggs per bird during the period from 16th October to 15th January, inclusive, has been awarded to Mrs. M. Wallace, Camlin, Roscrea, Co. Tipperary, for Pen No. 70 (White Leghorn) which produced 169 first grade eggs.

The special prize for the *Pen* of pullets (sitting breed) laying the highest average of first grade eggs per bird during the period 16th October to 15th January, inclusive, has been awarded to Mrs. A. Hartland, Croughtamore, Cork, for Pen No. 27 (White Wyandotte) which produced 305 first grade eggs.

The special prize for the *Individual Bird* (non-sitting breed) laying the highest number of first grade eggs during the Competition has been awarded to Miss K. F. O'Connor, The Rectory, Newbridge, County Kildare, for Pullet No. 61 (White Leghorn) which laid 246 first grade eggs.

The special prize for the *Individual Bird* (sitting breed) laying the highest number of first grade eggs during the Competition has been awarded to Mrs. M. L. Barker, The Rectory, Celbridge, County Kildare, for Pullet No. 214 (White Wyandotte) which laid 255 first grade eggs.

The special prize for the *Individual Bird* (non-sitting breed) laying the highest number of first grade eggs during the period 16th October to 15th January, inclusive, has been awarded to Mr. F. Stuart, Laragh Castle, Laragh, Rathdrum, County Wicklow, for Pullet No. 13 (White Leghorn) which laid 61 first grade eggs.

The special prize for the *Individual Bird* (sitting breed) laying the highest number of first grade eggs during the period 16th October to 15th January, inclusive, has been awarded to Mrs. M. L. Barker, The Rectory, Celbridge, County Kildare, for Pullet No. 214 (White Wyandotte) which laid 73 first grade eggs.

CERTIFICATES AWARDED.

Section I.—Non-Sitting Breeds.

Second Class Certificates.

Mrs. E. MacDonald, Ardnacarrig, Bandon, Co. Cork. (Pen 1, White Leghorn—1,151 Eggs.)

Mrs. M. G. King, Beech Grove, Donadea, Co. Kildare. (Pen 5, White Leghorn—1,131 Eggs).

Miss E. Cavanagh, Kimmage Grove, Terenure, Dublin, (Pen 13, Black Minorca—1,036 Eggs).

Section II.—White Wyandotte.

First Class Certificates.

Mrs. B. Deegan, Lodge Park, Freshford, Co. Kilkenny. (Pen 29—1,306 Eggs).
Mrs. A. Hartland, Croughtamore, Cork. (Pen 27—1,262 Eggs).
Mrs. M. G. King, Beech Grove, Donadea, Co. Kildare. (Pen 19—1,224 Eggs).
Mrs. J. R. Boyd, The Rectory, Shinrone, Offaly. (Pen 30—1,209 Eggs).
Mrs. E. MacDonald, Ardnacarrig, Bandon, Co. Cork. (Pen 14—1,203 Eggs).

Second Class Certificates.

Miss P. Brady, Newtowngirley, Kells, Co. Meath. (Pen 31—1,133 Eggs).
Mrs. N. Chearnley, Glendoneen, Ballinhassig, Co. Cork. (Pen 23—1,109 Eggs).
Mr. C. F. Harvey, Duffcarrig, Gorey, Co. Wexford. (Pen 21—1,067).

Section III.—Sitting Breeds (other than White Wyandotte).

First Class Certificate.

Miss S. D. Deane, Longraigue, Foulks Mills, Co. Wexford. (Pen 53, Buff Rock—1,290 Eggs).

Second Class Certificates.

Miss D. Strong, Moate House, Kells, Co. Meath. (Pen 48, Rhode Island Red—1,181 Eggs).
Miss P. White, Gortnafluir, Clonmel, Co. Tipperary. (Pen 56, Light Sussex—1,162 Eggs).
Mr. C. F. Harvey, Duffcarrig P.F., Gorey, Co. Wexford. (Pen 41, Rhode Island Red—1,071 Eggs).

Section IV.—Non-Sitting Breeds Station-holders).

Second Class Certificates.

Mrs. M. Wallace, Camlin, Roscrea, Co. Tipperary. (Pen 70, White Leghorn—1,163 Eggs).
Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick. (Pen 58, White Leghorn—1,149 Eggs).
Mrs. M. Kelleher, Shanakeil House, Kilcorney, Banteer, Co. Cork. (Pen 65, White Leghorn—1,135 Eggs).
Miss M. O'Brien, Philipstown Cottage, Cappawhite, Co. Tipperary. (Pen 68, White Leghorn—1,119 Eggs).
Mrs. H. O'Sullivan, Kiltanna, Knockaderry, Newcastle West, Co. Limerick. (Pen 59, White Leghorn—1,041).

SECTION V.—WHITE WYANDOTTE (STATION-HOLDERS).

Second Class Certificates.

Mrs. M. Drohan, Ballynevin, Carrick-on-Suir, Co. Waterford. (Pen 78—1,188 Eggs).

Miss K. Newman, Drinadaly, Trim, Co. Meath. (Pen 83—1,185 Eggs).

Mrs. M. Hanrahan, Ardreigh, Urlingford, Co. Kilkenny. (Pen 79—1,125 Eggs).

Miss A. Donegan, Monasterboice, Drogheda, Co. Louth. (Pen 73—1,038 Eggs).

Mrs. M. Byrne, Knockbutton, Windgap, Co. Kilkenny. (Pen 77—1,034 Eggs.)

SECTION VI.—SITTING BREEDS OTHER THAN WHITE WYANDOTTE (STATION-HOLDERS).

First Class Certificates.

Mrs. E. A. Henderson, Ardrum, Inniscarra, Co. Cork. (Pen 112, Barred Rock—1,282 Eggs).

Mrs. M. Doyle, Coolmanagh, Hacketstown, Co. Carlow. (Pen 93, Rhode Island Red—1,206 Eggs).

Second Class Certificates.

Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford. (Pen 89, Rhode Island Red—1,137 Eggs).

Mrs. K. McCabe, Derry, Aughnamullen, Ballybay, Co. Monaghan. (Pen 107, Buff Rock—1,108 Eggs).

Miss C. Mealiff, Ballinamona House, Tullamore, Offaly. (Pen 97, Rhode Island Red—1,101 Eggs).

Sister-in-Charge, Technical School, Stradbally, Leix. (Pen 105, Buff Rock—1,093 Eggs).

Mrs. B. Martin, Croughatens, Ballylooby, Cahir, Co. Tipperary. (Pen 98, Rhode Island Red—1,044 Eggs).

Mrs. B. Healy, Kildologue, Strokestown, Co. Roscommon. (Pen 95, Rhode Island Red—1,035 Eggs).

Mrs. E. Sheehy, Bridge House, Ballingarry, Co. Limerick. (Pen 88, Rhode Island Red—1,033 Eggs).

Mrs. L. Mounsey, Beech Hill, Tullamore, Offaly. (Pen 109, Buff Rock—1,033 Eggs).

DUCK SECTION.

First Class Certificate.

Miss D. Strong, Moate House, Kells, Co. Meath. (Pen 120, Indian Runner—937 Eggs).

Pullets which Qualified for Copper Rings.

The following Table gives particulars of the 103 pullets which laid 200 first grade eggs or over, and not more than 20 per cent. second grade.

Table VII.

White Leghorn (22 Pullets).

Pen Number	Pullet Number	Number of Sealed Ring.	Eggs Laid		Total	Owner.
			First Grade.	Second Grade.		
1	4 5 6	201 202 203	208 202 204	— 2 3	208 204 207	Mrs. E. MacDonald, Ardnacarrig, Bandon, Co. Cork.
2	8	204	206	13	219	Mr. F. C. Bernard, Belfield, Stillorgan Road, Ballsbridge, Dublin, S.E.1.
3	13	205	237	3	240	Mr. F. Stuart, Laragh Castle, Laragh, Rathdrum, Co. Wicklow.
5	26 27 29	206 207 208	211 215 237	— 6 2	211 221 239	Mrs. M. G. King, Beechgrove, Donadea, Co. Kildare.
6	31 33 36	209 210 211	215 210 217	9 3 —	224 213 217	Bro. Fintan Bergin, Our Lady of Lourdes, Cahermoyle, Ardagh, Co. Limerick.
11	61 64	212 213	246 239	10 —	256 239	Miss K. F. O'Connor, The Rectory, Newbridge, Co. Kildare.
59	351	217	208	5	213	Mrs. H. O'Sullivan, Kiltanna, Knockaderry, Newcastle-West, Co. Limerick.
64	382 383	218 219	206 208	22 9	228 217	Mrs. C. Mulcahy, Ballinahown, Ardagh, Co. Limerick.
65	385	220	208	10	218	Mrs. M. Kelleher, Shanakiel House, Kilcorney, Banteer, Co. Cork.
66	392 395	221 222	208 206	17 1	225 207	Miss L. Gould, Derryhoo, Milltown, Belturbet Co. Cavan.

Pen Number.	Pullet Number.	Number of Sealed Ring.	Eggs Laid. First Grade.	Eggs Laid. Second Grade.	Total	Owner
69	412	223	221	3	224	Miss M. E. Anglim, Farranaleen, Fethard, Co. Tipperary.
70	417 420	224 225	224 233	2 6	226 239	Mrs. M. Wallace, Camlin, Roscrea, Co. Tipperary.

White Wyandotte (42 Pullets).

Pen Number.	Pullet Number.	Number of Sealed Ring.	Eggs Laid First Grade.	Eggs Laid Second Grade.	Total	Owner.
14	79 80 84	301 302 303	216 208 233	11 10 26	227 218 259	Miss E. MacDonald, Ardnacarrig, Bandon, Co. Cork.
15	86 89	304 305	237 230	21 7	258 237	Mr. F. C. Bernard, Belfield, Stillorgan Road, Ballsbridge, Dublin, S.E. 1.
17	100	306	207	1	208	Mr. D. V. O'Grady, Minaville, Glanmire, Co. Cork.
18	104 106	307 308	226 235	5 12	231 247	Miss P. Alley, Hill Poultry Farm, Athboy, Co. Meath.
19	109 111	309 310	219 221	9 3	228 224	Mrs. M. G. King, Beechgrove, Donadea, Co. Kildare.
20	116	311	237	2	239	Mrs. G. Eyre-Studdert, Cragmoher, Corofin, Co. Clare.
21	122	312	225	12	237	Mr. C. F. Harvey, Duffcarrig, Gorey, Co. Wexford.
23	134 136 137	313 314 315	223 211 206	3 5 14	226 216 220	Mrs. M. Chearnley, Glendoneen, Ballinhassig, Co. Cork.

Pen Number.	Pullet Number.	Number of Sealed Ring.	Eggs Laid. First Grade.	Eggs Laid. Second Grade.	Total	Owner.
27	158 161	316 317	220 227	2 —	222 227	Mrs. A. Hartland, Croughtamore, Cork.
29	172	318	200	31	231	Mrs. B. Deegan, Lodge Park, Freshford, Co. Kilkenny.
30	178 180	319 320	213 207	4 18	217 225	Mrs. J. R. Boyd, The Rectory, Shinrone, Offaly.
31	182 184	321 322	231 239	5 9	236 248	Miss P. Brady, Newtowngirley, Kells, Co. Meath.
32	189	323	211	1	212	Miss P. White, Gortnafluir, Clonmel, Co. Tipperary.
33	193 194	324 325	205 217	14 3	219 220	Miss P. White, Gortnafluir, Clonmel, Co. Tipperary.
36	214	326	255	8	263	Mrs. M. L. Barker, The Rectory, Celbridge, Co. Kildare.
37	220 221	327 328	221 210	15 2	236 212	Miss E. Kavanagh, Kimmage Grove, Terenure, Dublin.
73	433 435	341 342	201 215	2 8	203 223	Miss A. Donegan, Monasterboice, Drogheda, Co. Louth.
74	444	343	217	1	218	Miss M. Byrne, Montevideo, Roscrea, Co. Tipperary.
77	460	344	225	10	235	Mrs. M. Byrne, Knockbutton, Windgap, Co. Kilkenny.
78	468	345	228	—	228	Mrs. M. Drohan, Ballynevin, Carrick-on-Suir, Co. Waterford.
79	470 471 474	346 347 348	207 202 202	— 1 9	207 203 211	Mrs. M. Hanrahan, Ardreigh, Urlingford, Co. Kilkenny.

Pen Number.	Pullet Number.	Number of Sealed Ring.	Eggs Laid. First Grade.	Eggs Laid. Second Grade.	Total	Owner.
82	487	349	219	4	223	Mrs. M. Colleran, Cranaghmore, Athlone, Co. Roscommon.
83	493 497 498	350 351 352	213 228 215	8 3 2	221 231 217	Miss K. Newman, Drinadaly, Trim, Co Meath.
87	520 521	353 354	209 227	3 10	212 237	Mrs. J. M. Walsh, Ballyvoreen House, Murroe, Co. Limerick.

RHODE ISLAND RED (19 Pullets).

Pen Number.	Pullet Number.	Number of Sealed Ring.	Eggs Laid. First Grade.	Eggs Laid. Second Grade.	Total	Owner.
41	245	329	223	5	228	Mr. C. F. Harvey, Duffcarrig P.F., Gorey, Co. Wexford.
43	253 255	330 331	213 209	1 5	214 214	Mrs. C. O'Shea, Codrum, Macroom, Co. Cork.
48	284 287	332 333	202 224	20 2	222 226	Miss D. Strong, Moate House, Kells, Co. Meath.
50	300	334	234	14	248	Mrs. K. Earl, Grantstown House, Ballinakill, Waterford.
51	304	335	220	8	228	Mrs. D. E. Chearnley, Salterbridge, Cappoquin, Co. Waterford.
52	308	336	201	—	201	Mrs. E. M. O'Flynn, Prohurst, Milford, Charleville, Co. Cork.
57	337 341	339 340	210 216	5 5	215 221	Miss A. Scanlan, Ballyduhig House, Ballagh, Charleville, Co. Limerick.
88	523	355	221	13	234	Mrs. E. Sheehy, Bridge House, Ballingarry, Co. Limerick.
89	532	356	218	14	232	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.

Pen No.	Pullet No.	No. of Sealed Ring.	Eggs Laid. First Grade.	Eggs Laid. Second Grade.	Total.	Owner.
93	554 555 557	357 358 359	200 203 206	1 4 13	201 207 219	Mrs. M. Doyle, Coolmanagh, Hacketstown, Co. Carlow.
95	566	360	210	1	211	Mrs. B. Healy, Kildologue, Strokestown, Co. Roscommon.
97	577	361	200	—	200	Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.
99	593	362	203	3	206	Mrs. E. Nugent, Clonkeefy, Ballyjamesduff, Co. Cavan.
101	603	363	241	3	244	Mrs. L. K. Murphy, Knockreigh, Adamstown, Co. Wexford.

BUFF ROCK (10 PULLETS).

Pen No.	Pullet No.	No. of Sealed Ring.	Eggs Laid. First Grade.	Eggs Laid. Second Grade.	Total.	Owner.
53	313 315	337 338	229 200	5 9	234 209	Miss S. D. Doane, Longraigue, Foulks Mills, Co. Wexford.
105	628 629 630	364 365 366	228 202 217	— 5 —	228 207 217	Sister-in-Charge, Technical Schl., Stradbally, Laoighis.
106	635	367	205	3	208	Mrs. V. McCann, Ballymun House, Santry, Co. Dublin.
107	638 642	368 369	204 202	1 7	205 209	Mrs. K. McCabe, Derry, Aughnamullen, Ballybay, Co. Monaghan.
109	652	370	236	—	236	Mrs. L. Mounsey, Beech Hill, Tullamore, Offaly.
111	662	371	202	—	202	Mrs. R. Ryan, Cluggin House, Oola, Co. Limerick.

BARRED ROCK (5 PULLETS).

Pen No.	Pullet No.	No. of Sealed Ring.	Eggs Laid. First Grade.	Eggs Laid. Second Grade.	Total.	Owner.
112	668 669 670 671 672	372 373 374 375 376	201 202 221 216 213	17 9 12 — 3	218 211 233 216 216	Mrs. E. A. Henderson, Ardrum, Inniscarra, Co. Cork.

BLACK MINORCA (5 PULLETS).

Pen Number	Pullet Number	Number of Sealed Ring.	Eggs Laid First Grade	Eggs Laid Second Grade	Total.	Owner.
13	75	214	200	12	212	Miss E. Cavanagh,
	76	215	205	4	209	Kimmage Grove, Terenure
	77	216	204	—	204	Dublin.
72	428	226	201	8	209	Mrs. R. Cochrane,
	429	227	222	14	236	Tullyroe, Tremane,
						Co. Roscommon.

SECTION I.—NON-SITTING BREEDS

Order of Merit.	Number of Pen	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
*	2	*White Leghorn.*	28/3/29	7	3 7	3 12	17	20	17	17	17	20	22	19	21	21	22	21	1	146	87	234	20	33 0¾	(a) 1,260	2	—	—	—
		Mr. F. C. Bernard,	,,	8	3 8	4 4	5	21	16	20	20	23	20	20	20	19	17	18	30	176	13	219	38	32 1¼	lbs. ozs. dr.	—	—	—	June.
		Belfield,	,,	9	3 8	4 4	16	10	—	5	16	17	22	22	22	3	19	15	—	90	77	167	1	20 8⅓	(b) 160 14 11	—	—	—	Dec., Jan., June, July
		Stillorgan Rd.,	,,	10	3 4	3 12	19	21	8	3	21	19	22	23	22	20	19	19	46	143	27	216	23	30 9¼	ozs. (c) 24·0	—	—	—	—
		Ballsbridge,	,,	11	3 8	4 0	16	8	—	17	25	26	26	17	11	24	25	26	—	34	187	221	1	25 2½	(d) £8 14 7	24	—	1	Dec.
		Dublin, S.E.1.	,,	12	3 12	4 8	16	17	21	20	13	22	24	24	25	22	17	12	—	164	69	233	33	32 9		—	—	—	—
1	5	*White Leghorn.*	21/3/29	25	3 8	5 0	13	18	11	9	13	6	5	—	—	—	—	—	4	50	21	75	34	13 7¼	(a) 1,131	4	—	—	July, Aug.
		Mrs. M. King,	21/4/29	26	3 8	5 8	2	19	18	9	16	20	24	24	23	21	21	14	188	23	—	211	44	30 3½	lbs. ozs. dr.	—	—	—	Aug.
		Beech Grove,	21/3/29	27	3 8	4 8	9	8	16	20	19	22	23	23	22	22	17	20	76	139	6	221	34	30 11¾	(b) 155 2 5	—	—	—	—
		Donadea,	21/3/29	28	3 8	—	19	20	19	19	19	21	22	23	22	5	—	—	19	107	63	189	10	27 0	ozs.	—	3/7/30	—	—
		Co. Kildare.	21/3/29	29	3 7	4 2	11	21	22	19	20	19	22	22	22	20	20	21	165	72	2	239	58	36 4¼	(c) 26·3	1	—	—	—
			,,	30	3 8	4 8	19	19	—	13	24	24	16	18	18	16	16	13	114	72	10	196	33	28 4	(d) £8 6 6¾	—	—	3	Dec., Jan. Aug.
2	1	*White Leghorn.*	26/3/29	1	4 0	—	9	14	18	15	17	5	—	—	—	—	—	—	26	45	7	78	38	14 5½	(a) 1,151	—	9/4/30	—	—
		Mrs. E. McDonald,	,,	2	4 0	4 8	19	6	—	7	21	23	24	23	22	22	23	19	46	140	23	209	8	27 2¾	lbs. ozs. dr.	—	—	—	Nov., Dec.
		Ardnacarrig,	,,	3	3 8	3 8	18	18	17	17	21	20	24	24	23	23	21	19	7	167	71	245	8	33 10	(b) 154 6 5	—	—	—	—
		Bandon,	,,	4	4 0	4 0	20	18	13	—	19	20	23	19	21	19	18	18	135	73	—	208	51	30 9½	ozs.	—	—	—	—
		Co. Cork.	,,	5	4 0	4 8	18	12	—	5	19	21	22	25	23	21	20	18	89	113	2	204	29	27 10¼	(c) 25·8	—	—	—	Dec., Jan.
			,,	6	3 10	4 0	13	16	18	18	19	18	17	21	18	20	15	14	111	93	3	207	50	31 1¾	(d) £8 5 3¾	—	—	—	Aug.
†	6	*White Leghorn.*	15/3/29	31	3 7	3 8	14	20	10	9	23	22	22	23	21	21	20	19	64	151	9	224	36	32 3½	(a) 1,018	—	—	—	Dec., Jan.
		Bro. Fintan Bergin,	,,	32	3 7	—	17	22	18	2	—	—	—	—	—	—	—	—	—	28	31	59	28	12 10½	lbs. ozs. dr.	—	11/1/30	—	—
		Our Lady of	,,	33	3 6	3 8	10	19	20	20	16	21	22	18	17	22	14	14	22	188	3	213	53	32 3	(b) 136 2 6	—	—	—	—
		Lourdes, Cahermoyle,	,,	34	3 7	4 0	4	20	20	20	19	23	20	18	21	17	16	15	18	181	14	213	43	31 4½	ozs.	3	—	—	—
		Ardagh,	,,	35	3 9	—	2	20	15	16	19	18	2	—	—	—	—	—	19	62	11	92	31	15 8½	(c) 25·7	—	28/4/30	—	—
		Co. Limerick.	,,	36	3 8	4 2	9	19	7	5	23	22	23	23	22	22	21	21	162	55	—	217	35	30 10¼	(d) £7 15 4¼	—	—	—	Dec., Jan.
3	13	*Black Minorca.*	April.	73	3 8	4 12	6	18	13	14	9	20	20	18	19	18	17	14	109	77	—	186	42	27 7¼	(a) 1,036	1	—	—	—
		Miss E. Cavanagh,	,,	74	3 6	—	10	13	—	2	—	—	—	—	—	—	—	—	—	5	20	25	5	5 3¾	lbs. ozs. dr.	—	30/1/30	—	Dec., Jan.
		Kimmage Grove,	,,	75	4 0	5 0	17	21	18	15	17	20	19	21	18	18	16	12	11	189	12	212	52	32 5½	(b) 140 6 12	—	—	—	—
		Terenure,	,,	76	3 7	4 0	15	—	8	15	20	21	22	23	23	19	22	21	60	145	4	209	22	28 1¼	ozs.	—	—	—	Oct.
		Dublin.	,,	77	4 8	5 0	13	9	15	8	19	21	25	23	15	20	19	17	142	62	—	204	40	29 0½	(c) 26·0	—	—	—	—
			,,	78	3 12	4 12	10	21	7	—	15	22	20	24	22	22	19	18	41	154	5	200	33	28 8¾	(d) £7 11 3	—	—	—	Jan., Feb., Aug., Sept

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). † Disqualified under Clause 21 (pen produced less than 1,020 eggs).

SECTION I.—NON-SITTING BREEDS.—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. Lbs. Ozs.	Weight. At Close of Test. Lb. Ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
																								s. d.					
*	8	*White Leghorn.* Mrs. N. McElligott,	6/4/29	43	3 12	4 8	13	20	15	9	20	24	22	23	22	19	16	16	41	142	36	219	17	30 10	(a) 1,112	—	—	—	—
		Bedford,	,,	44	3 12	4 4	10	11	6	20	19	20	23	21	25	22	22	18	—	12	205	217	—	24 4½	lbs. ozs. dr. (b) 138 13 7	38	—	—	—
		Listowel,	,,	45	3 8	4 8	—	18	16	19	23	25	23	24	22	20	18	18	30	169	27	226	25	31 3½	ozs.	—	—	—	—
		Co. Kerry.	,,	46	3 8	4 12	8	19	17	3	18	21	25	21	24	19	23	20	4	123	91	218	1	28 10¾	(c) 24·0	2	—	—	—
			,,	47	4 8	4 4	19	7	—	—	—	—	—	—	—	9	9	2	9	34	3	46	24	8 7¾	(d) £7 6 0¼	—	—	—	—
				48	4 0	4 4	5	2	8	11	9	20	22	22	22	23	21	19	—	92	92	184	4	21 8¾		6	—	—	—
				U.T.	—	—	—	—	—	—	2	—	—	—	—	—	—	—	1	1	—	2	—	0 3		—	—	—	—
†	3	*White Leghorn.* Mr. Francis Stuart,	March.	13	3 8	4 4	20	20	19	20	20	22	23	18	20	18	21	19	74	163	3	240	61	36 7	(a) 879	1	—	—	—
		Laragh Castle,	,,	14	3 8	—	17	18	—	3	20	19	11	—	—	—	—	—	81	7	—	88	35	14 3¼	lbs. ozs. dr.	—	22/4/30	—	Dec., Jan.
		Laragh,	April	15	3 6	4 0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(b) 120 4 1	—	—	—	—
		Rathdrum,	,,	16	3 0	4 0	—	—	13	18	3	16	20	25	21	20	10	19	41	121	3	165	17	21 8½	ozs.	—	—	—	—
		Co. Wicklow.	,,	17	3 7	3 12	10	17	16	15	14	18	16	18	20	19	14	16	3	141	49	193	13	27 4½	(c) 26·3	1	—	—	—
			,,	18	3 8	4 4	15	—	13	4	19	23	21	24	19	20	18	17	168	25	—	193	32	25 10¼	(d) £6 5 9½	—	—	—	Aug.
†*	11	*White Leghorn.*	13/3/29	61	4 4	4 12	5	21	6	22	24	26	27	27	27	24	25	25	17	229	10	256	28	35 9¼	(a) 900 lbs. ozs. dr.	—	—	—	June, July, Aug.
		Miss K. F. O'Connor, The Rectory,	23/2/29	62	3 8	3 8	10	—	4	19	9	22	23	25	23	22	19	11	21	154	12	187	12	24 0¼	(b) 120 6 6 ozs.	1	—	—	Nov., Dec., Sept.
		Newbridge,	4/4/29	63	4 0	4 6	11	—	13	20	20	21	24	18	18	17	21	16	2	34	163	199	3	22 5½	(c) 25·7	12	—	—	—
		Co. Kildare.	23/2/29	64	4 8	5 0	12	20	5	14	21	23	24	27	24	24	24	21	232	7	—	239	38	34 2¼	(d) £6 0 6½	—	—	—	—
			,,	65	5 0	—	5	—	—	—	—	—	—	—	—	—	—	—	—	5	—	5	5	0 11½		—	16/1/30	—	Oct., Nov.
			25/3/29	66	3 6	—	12	2	—	—	—	—	—	—	—	—	—	—	—	7	7	14	7	3 1¾		—	16/1/30	—	Oct.
†*	9	*White Leghorn.*	16/4/29	49	3 12	—	3	3	7	21	19	19	8	—	—	—	—	—	44	34	2	80	16	11 8¾	(a) 812	—	23/4/30	—	—
		Mrs. M. Rankin,	,,	50	4 0	4 12	6	17	—	—	17	22	21	24	21	19	21	13	154	26	1	181	22	24 5½	lbs. ozs. dr.	—	—	—	Sept.
		Ballyhaskey,	,,	51	3 12	4 12	17	—	—	20	20	18	22	—	6	19	—	12	33	86	15	134	9	18 3¾	(b) 105 15 5 ozs.	—	—	—	Oct., July, Aug.
		Newtown-cunningham,	,,	52	4 4	—	11	13	—	—	—	—	—	—	—	—	—	—	5	16	3	24	21	5 11	(c) 25·1	—	30-12-29	—	—
		Co. Donegal.	,,	53	3 8	4 0	16	17	8	8	20	20	24	16	15	18	11	21	—	5	189	194	—	23 1¾	(d) £5 8 8	51	—	—	Aug.
			14/5/29	54	3 8	5 0	—	9	11	3	20	24	24	26	23	19	21	16	17	144	35	196	1	24 8¾		1	—	—	July
				U.T.	—	—	—	—	1	—	—	—	—	1	1	—	—	—	—	—	3	3	—	0 4½		—	—	—	—

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs).
U.T. = Untrapped;

† Disqualified under Clause 21 (pen produced less than 1,020 eggs)

SECTION II.—WHITE WYANDOTTE.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
1	27	Mrs. A. Hartland, Croughtamore, Cork.	5/3/29	157	5 8	6 4	19	19	3	—	17	21	22	22	15	23	17	17	158	35	2	195	39	28 2½	(a) 1,262 lbs. ozs. dr.	—	—	—	Dec., Jan., Feb., Sept.
			,,	158	6 4	5 8	21	18	14	15	20	20	22	16	19	21	17	19	72	148	2	222	56	33 6¾	(b) 174 11 13	—	—	—	—
			,,	159	6 0	6 0	26	8	15	11	23	20	23	16	13	9	12	15	108	81	2	191	48	28 8¾	ozs. (c) 26·6	—	—	5	July, Aug., Sept.
			,,	160	5 8	6 4	24	22	12	7	21	22	17	16	15	16	12	15	79	118	2	199	58	30 10¾	(d) £9 10 2¾	—	—	7	Sept.
			,,	161	5 0	5 4	13	22	20	20	19	21	25	23	14	20	17	12	200	27	—	227	61	34 11¾		—	—	2	Aug.
			,,	162	5 8	5 8	21	22	13	19	18	21	24	21	15	9	23	21	11	174	42	227	43	33 7¾		1	—	2	Sept.
				U.T.	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	0 2½					
2	29	Mrs. B. Deegan, Lodge Park, Freshford, Co. Kilkenny.	3/4/29	169	5 8	5 8	26	23	23	19	23	19	18	16	10	4	16	15	68	122	22	212	57	34 0¼	(a) 1,306 lbs. ozs. dr.	—	—	—	—
			,,	170	4 8	5 0	16	6	15	19	19	21	21	15	20	13	20	20	39	153	13	205	32	29 2¾		—	—	1	—
			,,	171	5 0	5 12	22	21	22	21	20	23	21	22	21	20	6	21	3	136	101	240	13	33 10¾	(b) 169 2 14	—	—	1	—
			,,	172	4 8	5 0	23	8	—	20	21	23	24	24	23	24	22	19	1	199	31	231	8	31 2	ozs.	—	—	—	—
			,,	173	4 8	5 12	—	2	20	20	20	21	25	21	23	23	18	20	14	176	23	213	12	28 1¾	(c) 24·9	—	—	—	—
			,,	174	4 12	6 4	17	21	21	22	21	22	12	21	11	12	14	11	46	120	39	205	30	31 1	(d) £9 7 6½	—	—	2	July
3	19	Mrs. M. King, Beech Grove, Donadea, Co. Kildare.	—	109	4 8	5 8	15	21	19	20	23	22	23	18	16	19	16	16	67	152	9	228	60	34 6½	(a) 1,224 lbs. ozs. dr.	—	—	—	Aug.
			—	110	4 8	5 2	17	19	22	19	19	16	16	10	13	12	10	13	123	61	2	186	62	30 0¼		—	—	5	Sept.
			—	111	4 7	4 12	14	19	21	17	19	22	24	23	21	18	4	22	81	140	3	224	55	33 6¼	(b) 165 15 2	—	—	—	July, Aug.
			—	112	4 7	5 8	21	20	5	17	20	23	23	23	24	21	22	18	8	172	57	237	8	32 10	ozs.	1	—	—	Aug.
			—	113	4 8	5 8	14	26	22	14	15	22	23	10	7	13	8	8	98	83	1	182	68	29 9¾	(c) 26·0 (d) £9 4 8½	—	—	4	July, Aug., Sept.
			—	114	4 8	6 4	—	13	17	11	14	20	23	18	14	7	8	21	95	71	—	166	35	23 10		—	—	2	July, Aug.
				U.T.			—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	1	—	0 1¾					
*	15	Mr. F. C. Bernard, Belfield, Stillorgan Rd., Ballsbridge, Dublin, S.E.1.	12/3/29	85	4 8	4 12	10	22	13	16	12	10	5	—	—	12	3	6	8	16	85	109	2	16 8¾	(a) 1,249 lbs. ozs. dr.	12	—	—	Nov., Aug.
			,,	86	4 7	5 0	15	23	20	18	19	21	23	25	24	24	24	22	14	223	21	258	45	38 3		—	—	—	July, Aug.
			,,	87	4 6	5 8	17	20	17	15	17	17	19	21	19	18	17	17	2	165	47	214	41	31 8¼	(b) 158 2 0	—	—	—	Aug.
			,,	88	4 8	7 0	13	18	19	14	23	21	24	18	20	18	13	11	11	144	57	212	10	29 5	ozs.	—	—	—	Aug.
			,,	89	4 8	5 12	24	21	18	19	17	22	22	23	18	17	24	12	106	124	7	237	63	36 3	(c) 24·3	1	—	—	Aug.
			,,	90	4 8	5 4	21	22	17	6	18	19	21	22	19	17	19	18	2	88	129	219	—	29 5	(d) 9 1 9	8	—	—	Aug.
4	14	Mrs. E. McDonald, Ardnacarrig, Bandon, Co. Cork.	4/3/29	79	5 0	5 10	20	21	17	20	19	23	24	16	19	15	23	10	79	137	11	227	57	34 7	(a) 1,203 lbs. ozs. dr.	—	—	3	—
			,,	80	5 0	6 2	—	14	25	21	25	25	20	21	14	17	17	19	63	145	10	218	38	31 7¾		—	—	1	July
			,,	81	4 12	—	6	18	23	24	23	15	—	—	—	—	—	—	16	91	2	109	53	19 8¾	(b) 157 3 9	—	24/3/30	—	—
			,,	82	4 8	5 8	21	19	16	—	7	20	21	22	18	16	17	15	—	124	68	192	29	27 1¾	ozs.	—	—	—	—
			,,	83	5 0	5 2	16	22	13	—	10	21	23	24	10	20	20	19	24	164	10	198	44	29 7¼	(c) 25·1 (d) £9 0 6¾	—	—	1	Jan., Aug., Sept.
			,,	84	4 6	5 4	18	21	18	20	21	23	24	26	23	21	26	18	14	219	26	259	42	37 10¼		—	—	—	—

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.

SECTION II.—WHITE WYANDOTTE.—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
5	30	Mrs. J. R. Boyd, The Rectory, Shinrone, Offaly.	26/2/29	175	4 12	5 0	13	17	18	17	18	19	19	12	24	6	21	11	2	142	51	195	20	27 11¾	(a) 1,209	—	—	3	July
			,,	176	4 8	5 0	21	21	19	17	16	18	20	18	12	14	12	13	157	41	3	201	63	31 10¾	lbs. ozs. dr.	—	—	—	Sept.
			,,	177	5 0	5 8	—	8	21	18	20	21	15	16	14	13	12	16	48	118	8	174	31	24 8½	(b) 165 3 7 ozs.	—	—	4	Oct., Nov. Aug.
			,,	178	5 0	6 0	5	19	19	16	17	17	22	23	22	18	19	20	24	189	4	217	44	32 0¾	(c) 26·2	—	—	—	—
			,,	179	5 4	5 0	1	15	14	16	16	18	21	21	18	20	18	19	147	50	—	197	35	28 1½	(d) £8 19 6¼	—	—	—	Dec., Sept.
			,,	180	4 12	5 0	24	21	20	20	21	20	23	20	8	20	10	18	110	97	18	225	54	34 9		—	—	1	June, July
†*	22	Mrs. J. Murphy, Newrath, Waterford.	March	127	5 8	5 8	28	27	25	24	17	23	11	25	12	11	11	21	3	98	134	235	24	34 5½	(a) 1,221 lbs. ozs. dr.	1	—	3	July, Aug., Sept.
			,,	128	4 8	4 0	25	17	11	3	13	5	20	21	11	17	20	16	—	69	110	179	13	24 4½	(b). 148 14 7 ozs.	3	—	—	Aug., Sept.
			,,	129	5 0	5 8	28	25	20	22	16	20	22	14	13	12	13	21	24	139	63	226	34	34 7¼	(c) 23·4	—	—	4	July, Aug., Sept.
			,,	130	5 0	5 2	—	9	14	18	20	19	20	14	10	5	13	15	—	17	140	157	1	18 2½	(d) £8 14 11½	5	—	6	July, Aug.
			,,	131	4 8	5 8	15	23	21	23	23	23	21	7	15	15	11	20	8	118	91	217	66	31 0¼		—	—	2	June, Aug.
			,,	132	4 8	4 12	27	26	23	21	21	17	15	14	8	15	—	20	1	106	100	207	59	31 6¾		—	—	1	Aug.
*	20	Mrs. G. Eyre-Studdert, Craghmoher, Corofin, Co. Clare.	—	115	5 0	7 0	11	22	20	21	21	11	15	24	14	17	21	22	4	183	32	219	42	33 5½	(a) 1,049 lbs. ozs. dr.	—	—	2	—
			—	116	4 12	5 12	20	21	21	19	19	19	22	21	20	19	20	18	135	102	2	239	66	36 10¼	(b) 133 9 7 ozs.	—	—	—	—
			—	117	5 8	—	22	21	22	22	23	9	—	—	—	—	—	—	—	71	48	119	39	21 2¼		—	21/3/30	—	—
			—	118	4 8	5 0	8	22	15	19	18	8	8	20	21	19	19	19	1	71	124	196	—	26 7¼	(c) 24·5	1	—	—	July, Sept.
			—	119	4 10	5 4	25	24	23	22	14	18	12	13	—	—	5	2	10	116	32	158	56	27 0¼	(d) £8 6 0¼	—	—	—	—
			—	120	5 4	—	18	25	22	23	15	13	—	—	—	—	—	—	—	48	68	116	18	20 8		—	20/3/30	—	Oct., Nov.
				U.T.	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	2	—	2	—	0 2¾					
*	33	Miss P. White, Gortnafluir, Clonmel, Co. Tipperary.	March	193	5 6	5 12	9	20	22	19	19	20	21	22	17	18	17	15	33	172	14	219	53	32 9½	(a) 1,158 lbs. ozs. dr.	—	—	—	July, Aug., Sept.
			,,	194	5 0	6 8	13	10	19	19	19	20	22	22	19	22	20	15	196	21	3	220	44	32 2½	(b) 151 15 0 ozs.	—	—	—	July
			,,	195	4 8	4 8	—	—	14	17	19	20	19	21	18	13	14	7	3	151	8	162	18	20 11½	(c) 25·2	—	—	2	Oct., Nov., July
			,,	196	4 8	5 0	23	19	17	20	21	20	15	8	13	2	17	16	36	119	36	191	42	20 7	(d) £8 5 7¾	—	—	2	July
			,,	197	4 10	5 4	16	23	17	19	22	21	15	19	10	19	10	20	—	55	156	211	3	28 3¼		12	—	1	July
			,,	198	4 10	4 4	20	17	7	—	18	24	21	12	15	9	12	—	1	99	55	155	42	21 10		1	—	2	Aug., Sept.
6	23	Mrs. N. Chearnley, Glendoneen, Ballinhassig, Co. Cork.	11/2/29	133	4 12	5 8	5	13	12	13	12	15	20	19	18	14	16	13	135	35	—	170	32	24 6¾	(a) 1,109 lbs. ozs. dr.	—	—	—	Aug.
			17/1/29	134	5 0	5 4	20	12	11	22	24	20	24	27	23	10	20	13	104	119	3	226	46	32 8¼		—	—	1	July, Aug.
			18/2/29	135	5 4	—	18	21	18	—	—	—	—	—	—	—	—	—	3	50	4	57	53	13 5¾	(b) 149 11 0 ozs.	—	22/1/30	—	—
			28/2/29	136	5 4	6 2	—	3	—	22	20	25	25	25	25	25	25	21	40	171	5	216	7	27 4¼		—	—	—	—
			27/1/29	137	4 8	4 4	11	15	16	17	19	22	21	25	21	15	19	19	55	151	14	220	35	31 6¼	(c) 25·9	—	—	—	Aug.
			,,	138	4 12	4 8	8	15	20	22	14	24	22	20	18	19	16	19	23	165	29	217	41	31 0	(d) £8 0 11¼	—	—	—	Sept.
				U.T.	—	—	—	—	—	1	—	—	—	—	2	—	—	—	—	—	3	3	1	0 4					

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs).

† Disqualified under Clause 19 (eggs failed to reach standard weight of 24 ozs. per dozen).

U.T.=Untrapped.

SECTION II.—WHITE WYANDOTTE.—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. Lbs. Ozs.	Weight. At Close of Test. Lb. Ozs.	Eggs Laid. 16 Oct.-12 Nov.	Eggs Laid. 13 Nov.-10 Dec.	Eggs Laid. 11 Dec.-7 Jan.	Eggs Laid. 8 Jan.-4 Feb.	Eggs Laid. 5 Feb.-4 Mar.	Eggs Laid. 5 Mar.-1 Apl.	Eggs Laid. 2 Apl.-29 Apl.	Eggs Laid. 30 Apl.-27 May	Eggs Laid. 28 May-24 June	Eggs Laid. 25 June-22 July	Eggs Laid. 23 July-19 Aug.	Eggs Laid. 20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	Eggs per Pullet. First Grade.	Eggs per Pullet. Second Grade.	Eggs per Pullet. Total.	Eggs per Pullet. First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
7	31	Miss P. Brady,	11/3/29	181	4 7	—	1	3	—	—	—	—	—	—	—	—	—	—	1	2	1	4	3	0 11½	(a) 1,133	—	19/11-2	—	—
		Newtowngirley,	,,	182	4 7	5 0	10	6	19	21	20	23	21	25	23	23	23	22	45	186	5	236	37	33 4	lbs. ozs. dr.	—	—	—	Oct.
		Kells,	,,	183	4 8	4 4	23	7	16	20	23	24	26	23	11	16	18	16	6	164	53	223	25	30 11	(b) 145 14 0	1	—	3	Aug.
		Co. Meath.	,,	184	5 0	4 8	25	8	13	23	23	25	25	24	22	20	20	20	84	155	9	248	46	35 4	ozs.	—	—	—	July, Aug.
			,,	185	4 8	5 4	22	19	17	19	20	21	23	23	23	23	17	17	3	130	111	244	5	33 4¾	(c) 24·6	1	—	—	Aug.
			,,	186	4 8	4 12	18	7	7	19	17	21	12	20	16	14	14	13	9	132	37	178	23	24 10¼	(d) £7 18 9½	—	—	3	Oct., July., Sept.
*	35	Mrs. M. Nagle,	10/3/29	205	5 4	6 4	—	5	8	—	11	19	24	23	24	23	22	21	178	2	—	180	13	23 2	(a) 1,103	—	—	—	July
		Springmount,	,,	206	5 0	5 0	21	19	10	—	11	24	23	25	23	22	22	20	3	191	26	220	43	31 6¼	lbs. ozs. dr.	—	—	—	Jan., Feb., July
		Mallow,	,,	207	5 8	4 12	24	22	18	21	21	19	22	24	21	22	21	25	—	139	121	260	30	36 3¼	(b) 142 15 0	—	—	—	July
		Co. Cork.	,,	208	4 12	—	23	21	19	18	11	5	4	—	—	—	—	—	21	62	18	101	51	19 7¼	ozs.	—	30/4/30	—	—
			,,	209	4 8	—	21	21	16	15	22	22	23	22	22	18	—	—	—	89	113	202	6	27 1½	(c) 24·9	—	8/9/30	—	July, Aug.
			,,	210	4 12	6 0	18	14	—	2	19	14	19	8	8	12	16	8	2	112	24	138	29	19 11	(d) £7 17 11	1	—	5	Dec., Jan., July
				U.T.	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	2	—	2	1	0 3¼					
†*	36	Mrs. M. L. Barker,	4/3/29	211	5 4	—	3	10	20	7	—	—	—	—	—	—	—	—	—	33	7	40	32	8 10¼	(a) 1,154	—	20/1/30	—	—
		The Rectory,	30/3/29	212	4 8	6 0	—	17	12	6	2	20	22	22	21	8	16	16	16	137	9	162	25	22 10¼	lbs. ozs. dr.	—	—	—	Aug.
		Celbridge,	,,	213	5 0	5 8	14	11	11	12	22	19	22	19	20	18	17	19	1	74	129	204	10	26 0¼	(b) 142 9 1	2	—	—	Oct., Aug.
		Co. Kildare.	4/3/29	214	5 0	6 0	24	25	21	21	21	23	23	22	20	22	21	20	87	168	8	263	73	40 8½	ozs.	1	—	—	July
			30/3/29	215	5 0	6 0	—	—	22	21	25	24	26	17	25	15	20	25	1	43	176	220	3	25 1	(c) 23·7	2	—	2	Oct., Nov., July
			,,	216	4 8	4 12	27	22	14	7	25	25	26	23	25	23	26	22	—	10	255	265	8	31 8½	(d) £7 15 2¾	4	—	—	Nov., Aug.
†	26	Mrs. N. McElligott,	17/3/29	151	5 0	5 4	18	21	20	18	18	7	21	12	8	22	12	21	170	26	2	198	62	31 10¼	(a) 1,018	—	—	—	July, Aug.
		Bedford,	,,	152	5 0	5 0	12	19	10	—	5	18	19	22	18	11	20	19	53	116	4	173	38	25 9½	lbs. ozs. dr.	—	—	1	Jan., Feb.
		Listowel,	,,	153	5 0	6 0	11	14	13	—	13	24	24	19	19	16	18	15	110	71	5	186	33	26 6½	(b) 139 6 8	—	—	—	—
		Co. Kerry.	,,	154	4 12	4 8	—	16	19	15	—	2	19	10	10	14	10	17	—	91	41	132	17	19 8¾	ozs.	—	—	4	Aug.
			,,	155	5 0	4 4	13	20	7	7	17	18	20	19	18	2	7	11	26	122	11	159	31	23 6½	(c) 26·3	—	—	—	Oct.
			,,	156	5 0	5 4	14	19	13	—	3	18	18	15	12	18	17	23	62	106	2	170	45	25 10¾	(d) £7 13 4	—	—	4	Jan., Feb., Aug.
†*	34	Mrs. J. Simpson,	—	199	4 10	5 12	15	17	14	15	17	18	21	19	9	11	13	10	1	96	82	179	1	24 6¼	(a) 1,062	—	—	—	Aug.
		Clonoulty,	—	200	5 4	6 0	9	19	21	18	18	18	21	21	18	16	14	15	105	88	15	208	40	30 10¼	lbs. ozs. dr.	—	—	—	July
		Goold's Cross,	—	201	5 0	5 8	—	15	15	13	14	16	17	18	10	9	7	3	—	86	51	137	6	18 4¾	(b) 132 0 11	2	—	—	July, Aug.
		Co. Tipperary.	—	202	4 8	4 12	10	16	17	18	17	18	15	18	11	14	13	11	—	11	167	178	—	22 4	ozs.	—	—	—	Aug., Sept.
			—	203	5 4	5 12	19	21	18	16	18	20	20	18	15	20	15	14	6	186	22	214	51	32 6¾	(c) 23·9	—	—	—	—
			—	204	4 8	4 4	12	20	6	13	7	17	20	19	18	14	—	—	—	18	128	146	4	18 8	(d) £7 7 4¼	—	—	2	July, Aug., Sept.

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). † Disqualified under Clause 19 (eggs failed to reach standard weight of 24 ozs. per dozen).

Disqualified under Clause 21 pen produced less than 1,020 eggs). U.T. = Untrapped.

SECTION II.—WHITE WYANDOTTE.—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
8	21	Mr. C. F. Harvey, Duffcarrig, Gorey, Co. Wexford.	20/3/29	121	5 4	6 0	14	8	—	5	11	10	25	26	24	19	21	21	—	115	69	184	4	23 1½	(a) 1,067	1	—	1	Dec., Jan., June
			,,	122	5 4	6 4	18	21	20	19	19	18	24	21	17	19	22	19	82	143	12	237	53	36 0	(b) lbs. ozs. dr. 140 12 14	—	—	—	Sept.
			14/3/29	123	6 4	6 8	—	12	21	22	22	13	18	15	12	12	15	15	67	106	4	177	40	26 5	(c) ozs. 25·3	1	—	4	Aug.
			5/3/29	124	5 4	—	9	15	6	12	16	20	20	21	23	18	17	6	10	142	31	183	2	24 8½	(d) £7 7 1¾	1	2/9/30	—	July, Aug., Nov., Dec.
			,,	125	5 0	6 12	4	—	—	—	—	13	15	15	12	13	11	11	25	28	41	94	1	10 6		1	—	—	Jan., June
			,,	126	5 0	6 12	14	19	2	—	19	24	24	21	21	21	19	8	38	131	23	192	22	26 4¾		1	—	—	Dec., Jan., Aug., Sept.
†‡*	16	Mr. R. N. Tweedy, Hinchoge, Carrickmines, Co. Dublin.	March	91	4 10	5 4	20	19	19	17	19	11	15	22	13	18	17	14	—	91	113	204	31	28 7½	(a) 1,012	2	—	2	Oct., Aug
			April	92	5 2	4 8	17	19	20	19	20	20	21	11	23	13	20	22	6	150	69	225	4	32 2¼	(b) lbs. ozs. dr. 124 8 11	1	—	2	Oct.
			March	93	4 10	—	16	14	9	10	—	—	—	—	—	—	—	—	1	27	21	49	23	10 3¼	(c) ozs. 23·6	—	31/1/30	—	—
			,,	94	5 4	6 0	20	22	20	18	17	20	13	13	20	13	24	21	6	188	27	221	50	34 1¾	(d) £7 2 11½	3	—	1	June, July, Aug.
			,,	95	4 10	6 0	—	—	—	2	13	13	23	24	23	21	21	20	—	17	143	160	—	15 7½		—	—	—	Oct., Nov., Aug.
			,,	96	5 0	6 0	23	21	—	3	19	19	12	13	12	14	12	4	1	99	52	152	21	21 11¾		—	—	4	Jan., Feb., July, Aug.
				U.T.	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	1	—	0 1½					
‡	24	Mrs. R. B. Eadie, The Poplars, Beaufort, Co. Kerry.	24/2/29	139	4 8	—	18	17	6	—	—	—	—	—	—	—	—	—	8	31	2	41	39	9 5½	(a) 894	—	22/12/29	—	—
			,,	140	4 8	5 0	14	20	6	1	17	8	16	14	12	14	20	15	18	131	8	157	39	23 11½	(b) lbs. ozs. dr. 121 0 8	—	—	7	Aug.
			,,	141	5 4	5 4	19	17	8	—	16	13	23	14	18	15	13	24	25	147	8	180	43	26 10½	(c) ozs. 26·0	—	—	3	Jan., Feb., Aug.
			,,	142	5 4	6 8	—	21	20	20	22	21	22	11	20	11	10	18	88	106	2	196	46	29 5¼	(d) £6 17 3¼	—	—	3	Oct., Nov., Jan., Aug.
			14/2/29	143	4 7	4 8	6	17	17	17	16	20	14	13	—	—	—	—	7	94	19	120	34	18 6		—	—	1	June, July, Aug.
			9/3/29	144	5 12	7 4	19	21	5	—	15	23	25	19	18	14	20	21	7	175	18	200	36	29 0½		—	—	2	—
‡*	37	Miss E. Cavanagh, Kimmage Grove, Terenure, Dublin.	April	217	5 0	6 12	10	16	20	20	23	23	18	23	14	18	21	20	31	152	48	226	16	32 3¼	(a) 882	1	—	1	July
			,,	218	4 6	—	14	9	—	—	—	—	—	—	—	—	—	—	—	10	13	23	10	5 2½	(b) lbs. ozs. dr. 114 8 8	—	25/11/29	—	—
			,,	219	4 8	6 4	—	14	23	22	24	14	22	16	13	3	—	—	1	33	117	151	—	19 3¾	(c) ozs. 24·9	2	—	1	June, July, Aug.
			,,	220	4 8	5 12	16	18	20	18	16	21	22	25	20	20	22	18	17	204	15	236	45	35 2¼	(d) £6 10 9	—	—	—	July
			,,	221	4 8	5 12	20	18	11	—	18	23	23	23	16	22	20	18	112	98	2	212	47	30 9		—	—	—	July
			,,	222	4 8	3 8	18	16	—	—	—	—	—	—	—	—	—	—	—	27	7	34	27	7 11¾		—	—	—	June, July, Aug.

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs).
‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).
† Disqualified under Clause 19 (eggs failed to reach standard weight of 24 ozs. per dozen).
U.T. = Untrapped.

SECTION II.—WHITE WYANDOTTE.—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
†‡*	28	Mrs. W. J. Stevens, Athleague, Co. Roscommon.	March	163	4 12	5 0	14	22	22	17	21	20	24	18	13	—	19	4	17	164	13	194	54	29 9½	(a) 862 lbs. ozs. dr. (b) 106 7 3 ozs. (c) 23·7 (d) £6 9 4	1	—	1	June, July, Sept.
			,,	164	4 6	4 4	15	11	13	11	8	14	14	8	18	14	26	6	—	12	146	158	—	19 11½		93	—	3	Aug.
			,,	165	4 12	6 0	19	21	13	—	—	—	—	—	—	—	—	—	—	—	53	53	—	10 8½		4	—	—	July, Aug., Sept.
			,,	166	4 6	4 12	19	20	14	11	18	21	15	19	19	19	18	12	48	139	18	205	45	30 8½		—	—	—	—
			,,	167	4 12	5 12	9	18	20	22	19	18	21	22	15	7	20	20	2	74	135	211	1	28 0¾		—	—	1	June, July
			,,	168	4 6	—	13	21	5	—	—	—	—	—	—	—	—	—	—	37	2	39	37	9 9½		—	22-12 29	—	—
				U.T.	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	2	—	2	—	0 3¾					
‡*	25	Miss E. M. Haiman, Crossdrum, Oldcastle, Co. Meath.	20/3/29	145	4 8	7 0	4	14	15	20	18	21	22	19	21	13	16	11	2	124	68	194	15	25 9¾	(a) 923 lbs. ozs. dr. (b) 117 6 0 ozs. (c) 24·4 (d) 6 1 1½	—	—	—	July, Sept.
			20/3/29	146	4 8	6 8	—	3	—	4	12	21	19	20	20	20	18	15	10	115	27	152	—	17 9¼		—	—	—	Jan.
			,,	147	4 8	—	5	18	11	21	21	25	24	21	12	10	—	—	4	72	92	168	16	21 9¼		—	15/9/30	—	Jan.
			5/4/29	148	4 8	7 0	—	—	16	22	21	26	19	24	15	13	18	15	54	128	7	189	20	24 11¾		—	—	—	—
			9/3/29	149	4 10	6 8	10	18	16	21	23	23	22	15	19	9	21	20	1	138	78	217	29	30 2¼		—	—	2	—
			,,	150	4 10	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	0 7¼		—	9/12/29	—	—
‡	17	Mr. D. V. O'Grady, Minaville, Glanmire, Co. Cork.	February	97	4 12	—	6	—	—	—	—	—	—	—	—	—	—	—	—	5	1	6	5	1 3¼	(a) 812 lbs. ozs. dr. (b) 112 7 9 ozs. (c) 26·6 (d) £5 18 6¾	—	4/6/30	—	—
			,,	98	5 2	7 0	8	16	16	17	16	13	15	7	15	15	12	6	111	45	—	156	45	24 6¼		—	—	—	June, Sept.
			,,	99	5 4	7 0	25	18	—	3	21	14	17	10	17	12	17	11	18	126	21	165	34	24 2¾		—	—	2	Dec., Jan., June, July
			,,	100	5 4	7 8	13	21	19	20	20	20	22	19	14	6	16	18	167	40	1	208	58	32 4½		—	—	2	July, Aug.
			,,	101	5 8	—	—	—	—	9	17	23	24	21	10	—	—	—	93	11	—	104	—	11 7½		—	24/6/30	—	—
			,,	102	5 0	6 2	—	17	16	4	8	22	23	20	12	12	18	21	13	147	13	173	35	24 6½		—	—	1	Oct., Nov. June, July
‡	18	Miss P. Alley, Hill Poultry Farm, Athboy, Co. Meath.	20/3/29	103	5 0•	—	7	5	—	—	—	—	—	—	—	—	—	—	—	8	4	12	8	2 10	(a) 773 lbs. ozs. dr. (b) 102 3 13 ozs. (c) 25·4 (d) £5 17 6	—	25/11/29	—	—
			26/3/29	104	5 0	6 4	24	22	21	18	19	19	20	19	20	16	20	13	102	124	5	231	69	36 5½		—	—	—	July, Aug., Sept.
			20/3/29	105	5 8	5 12	17	6	—	13	16	19	18	18	18	16	9	19	75	87	7	169	20	23 1¾		—	—	2	Dec., Jan., July, Aug.
			26/3/29	106	4 8	5 12	26	10	3	19	26	25	24	26	23	24	21	20	78	157	12	247	36	34 6		—	—	—	Aug.
			5/4/29	107	4 6	—	19	19	22	21	14	—	—	—	—	—	—	—	—	3	92	95	2	16 6		2	31/3/30	—	—
			26/3/29	108	5 0	—	12	7	—	—	—	—	—	—	—	—	—	—	—	11	8	19	11	4 0¾		—	29/11/29	—	—

SECTION II.—WHITE WYANDOTTE—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade— 16 Oct.-15 Jan.	Value per Pullet.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
‡	32	Miss P. White, Gortnafluir, Clonmel, Co. Tipperary.	March	187	5 8	6 8	—	—	14	19	21	21	21	5	17	11	7	22	8	122	28	158	15	20 2¾	(a) 742 lbs. ozs. dr. (b) 100 1 15 ozs. (c) 25·9 (d) £5 11 7¼	—	—	3	Oct., Nov, July, Aug.
			,,	188	4 12	—	15	7	—	—	—	—	—	—	—	—	—	—	—	15	7	22	15	5 1½		—	25/11/29	—	—
			,,	189	5 0	5 8	16	21	21	21	20	22	23	12	14	12	21	9	172	39	1	212	64	33 10¾		—	—	4	Aug.
			,,	190	5 8	4 8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	Jan., Feb., July, Aug.
			,,	191	5 0	6 8	16	21	21	19	19	19	19	15	9	12	10	10	111	79	—	190	64	30 8½		—	—	—	July, Aug.
			,,	192	5 0	6 4	—	4	21	23	14	18	11	13	9	10	20	16	—	83	76	159	25	21 4¾		2	—	5	Oct., Nov., July
				U.T.	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	1	1	0 3					

‡ Disqualified under Clause 21 (pen produced less than 1,000 eggs). U.T. = Untrapped.

SECTION III.—SITTING BREEDS (OTHER THAN WHITE WYANDOTTE).

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
1	53	*Buff Rock.*	March	313	5 8	6 0	23	11	—	—	24	21	27	28	25	27	26	22	45	184	5	234	34	31 10	(a) 1,290	—	—	—	Aug.
		Miss S. Deane,	,,	314	5 10	5 8	18	22	20	19	21	21	23	21	10	21	10	21	10	183	34	227	41	34 0½	lbs. ozs. dr.	—	—	2	Aug.
		Longraigue,	,,	315	6 4	7 8	13	13	—	19	23	23	24	26	21	12	19	16	58	142	9	209	29	28 11½	(b) 168 6 4	1	—	1	Dec., Aug.
		Foulk's Mills,	,,	316	5 14	6 4	17	12	—	17	24	26	24	26	24	20	20	17	36	141	50	227	29	30 1½	ozs.	—	—	—	—
		Co. Wexford.	,,	317	5 8	7 0	20	11	—	10	21	21	25	24	22	21	20	19	—	112	102	214	1	26 6½	(c) 25·1	1	—	—	Dec., Aug.
			,,	318	5 14	6 4	14	10	—	17	21	24	27	23	21	7	—	15	57	113	9	179	26	24 3	(d) £8 15 9	2	—	—	Dec., July
2	48	*Rhode I. Red.*	28/2/29	283	5 8	7 0	—	11	11	—	10	19	22	24	17	22	23	21	81	97	2	180	21	24 4¾	(a) 1,181	—	—	—	Aug.
		Miss D. Strong,	11/3/29	284	4 8	6 0	14	19	13	15	19	20	20	24	18	21	21	18	78	124	20	222	30	32 6	lbs. ozs. dr.	—	—	—	Aug.
		Moate House,	12/3/29	285	4 8	5 12	4	12	14	11	11	24	23	22	18	15	18	20	17	152	23	192	26	26 5¼	(b) 160 7 11	—	—	3	—
		Kells,	3/3/29	286	5 0	4 8	—	6	21	17	17	3	26	24	26	20	6	—	75	90	1	166	31	23 0¾	ozs.	1	—	—	Aug.
		Co. Meath.	22/2/29	287	4 12	5 8	7	22	19	21	20	23	23	24	18	2	24	23	146	78	2	226	52	34 2	(c) 26·1	—	—	—	—
			27/3/29	288	4 8	5 12	—	6	22	18	20	23	23	16	25	11	19	12	33	157	5	195	31	27 0½	(d) £8 7 7¼	—	—	3	Nov., Sept.
3	56	*Light Sussex.*	March	331	6 0	6 12	19	19	19	18	19	19	17	14	15	14	14	8	105	90	—	195	62	30 7¾	(a) 1,162	—	—	1	July
		Miss P. White,	,,	332	5 8	6 0	24	5	16	13	24	13	17	14	16	16	16	14	4	148	36	188	30	26 9¼	lbs. ozs. dr.	3	—	4	July
		Gortnafluir,	,,	333	5 8	6 0	—	3	4	19	19	21	21	25	22	21	21	18	12	178	4	194	11	24 10¼	(b) 150 7 2	—	—	—	Oct., Sept.
		Clonmel,	,,	334	5 8	6 4	21	10	23	25	21	24	21	16	8	14	17	17	8	158	51	217	46	32 4	ozs.	1	—	3	Aug.
		Co. Tipperary.	,,	335	6 0	6 8	—	—	—	1	20	22	25	26	23	17	20	18	3	151	18	172	—	20 0¼	(c) 24·9	—	—	2	Aug.
			,,	336	5 8	7 0	16	22	16	14	10	20	20	19	14	19	16	9	3	158	34	195	39	29 4¾	(d) £8 4 1½	—	—	—	Aug.
				U.T.	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	1	—	0 1¼					
*	132	*Rhode I. Red.*	—	755	4 8	5 0	13	12	20	19	19	22	24	25	15	23	18	22	1	165	66	232	34	31 11¾	(a) 1,147	—	—	1	July
		Mrs. C. O'Shea,	—	756	4 12	5 8	20	2	24	23	24	22	22	22	21	17	16	18	4	114	113	231	44	30 6¾	lbs. ozs. dr.	1	—	—	July
		Codrum,	—	757	4 8	4 8	8	23	21	19	22	23	20	13	10	5	19	15	11	180	7	198	57	31 0¾	(b) 148 4 7	—	—	4	July
		Macroom,	—	758	5 0	—	10	12	—	1	21	19	6	—	—	—	—	—	1	29	39	69	5	9 7½	ozs.	—	17/4/30	—	—
		Co. Cork.	—	759	5 0	7 0	17	6	19	8	10	21	23	19	24	20	14	6	163	24	—	187	46	26 11¼	(c) 24·8	—	—	—	Aug.
			—	760	4 8	4 12	20	21	18	18	20	20	21	22	17	16	18	18	—	122	107	229	28	31 9¾	(d) £8 2 2¼	—	—	—	July.
				U.T.	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	1	—	0 2½					
4	41	*Rhode I. Red.*	5/3/29	241	4 8	6 8	8	—	17	18	19	21	22	24	22	13	9	—	101	72	—	173	31	23 6½	(a) 1,071	—	—	—	Aug.
		Mr. C. F. Harvey,	12/3/29	242	5 0	6 8	23	1	10	21	21	23	23	20	20	20	21	15	16	171	31	218	12	29 5½	lbs. ozs. dr.	—	—	—	Aug.
		Duffcarrig,	16/3/29	243	5 4	5 12	16	6	—	18	20	18	23	10	22	23	11	17	27	143	14	184	21	24 9¼	(b) 139 11 10	—	—	4	July
		Gorey,	5/3/29	244	4 8	5 8	23	5	—	15	21	23	23	25	9	21	9	20	2	90	102	194	1	24 3½	ozs.	2	—	1	Aug.
		Co. Wexford.	,,	245	5 4	6 4	5	22	19	17	17	22	26	25	21	20	19	15	17	206	5	228	50	33 6½	(c) 25·0	—	—	—	—
			,,	246	5 0	7 0	10	18	9	13	11	11	—	—	—	—	—	—	4	64	4	72	35	13 10	(d) £7 9 8¾	—	—	—	July
				U.T.	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	1	—	2	—	0 3½					

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.

SECTION III.—SITTING BREEDS (OTHER THAN WHITE WYANDOTTE).—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test. lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade - 16 Oct.-15 Jan.	Value per Pullet.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
*	47	*Rhode I. Red.* Mrs. E. M. Dennehy, Ballymanus, Stradbally, Laoighis.	10.3.29	277	4 8	5 8	—	21	23	20	22	25	20	23	23	13	17	—	—	31	176	207	11	25 7½	(a) 1,108	2	—	1	Aug.
			,,	278	4 8	6 0	16	—	18	17	19	18	22	21	22	20	22	21	1	34	181	216	3	24 10½	lbs. ozs. dr.	2	—	—	Aug.
			,,	279	5 4	6 0	—	18	18	19	18	20	22	19	15	19	16	5	32	156	1	189	40	27 7	(b) 140 13 10	—	—	—	July
			,,	280	4 8	6 4	4	7	—	13	17	19	19	23	19	12	19	19	12	148	11	171	7	22 3½	ozs.	—	—	—	Aug.
			,,	281	4 8	6 8	15	7	18	6	13	21	21	15	18	8	6	3	93	53	5	151	41	21 10¾	(c) 24·4	—	—	—	—
			,,	282	4 8	5 0	14	22	19	13	—	7	21	19	17	15	14	9	13	123	34	170	38	26 6¼	(d) £7 9 2¼	1	—	2	Feb.
				U.T.	—	—	—	—	—	—	—	—	—	1	—	—	—	3	—	—	4	4	—	0 5¼		—	—	—	—
‡	45	*Rhode I. Red.* Mrs. M. Burton, Mine Hill, Millstreet, Co. Cork.	March	265	4 7	5 0	1	11	12	—	—	14	14	17	15	14	14	13	30	93	2	125	23	18 1¼	(a) 992	—	—	6	Jan.
			,,	266	5 0	5 0	18	17	2	—	11	23	27	25	24	20	18	23	4	186	18	208	33	28 8¾	lbs. ozs. dr.	—	—	—	Jan.
			,,	267	5 0	5 12	22	23	18	19	12	10	22	18	18	15	17	13	1	174	32	207	67	32 3½	(b) 130 0 1	—	—	5	—
			,,	268	4 8	4 8	—	—	—	12	15	23	25	24	20	21	21	20	74	103	4	181	—	22 1¾	ozs.	—	—	—	Oct., Jan.
			,,	269	4 10	—	17	24	18	19	20	21	25	20	8	—	—	—	55	113	4	172	64	27 9½	(c) 25·2	—	16/8/30	1	—
			,,	270	4 8	—	24	22	9	—	8	19	16	—	—	—	—	—	2	59	37	98	34	16 7½	(d) £7 5 9¾	—	31/5/30	—	—
				U.T.	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	1	—	0 1½					
‡	43	*Rhode I. Red.* Mrs. C. O'Shea, Codrum, Macroom, Co. Cork.	28.2.29	253	5 8	6 0	15	18	—	3	21	21	23	24	25	21	21	22	82	131	1	214	33	30 1½	(a) 969	—	—	—	—
			,,	254	5 0	—	20	23	15	—	—	12	—	—	—	—	—	—	1	62	7	70	53	15 0¾	lbs. ozs. dr.	—	17/4/30	—	Jan.
			March	255	5 0	5 8	19	23	22	20	13	20	21	19	16	16	11	14	27	182	5	214	66	33 11½	(b) 128 14 14	—	—	1	July
			,,	256	4 8	5 4	22	—	—	—	19	16	18	14	13	11	15	15	5	82	56	143	5	17 9	ozs.	1	—	6	Nov.
			,,	257	5 8	6 4	18	7	12	18	21	23	21	22	20	2	18	6	36	149	3	188	41	26 3	(c) 25·5	—	—	3	July, Sept.
			,,	258	5 0	5 4	17	10	12	7	17	20	16	7	8	—	4	17	73	61	1	135	39	20 10¾	(d) £7 4 7	—	—	—	June
				U.T.	—	—	—	—	—	1	—	—	—	—	—	3	—	1	1	4	—	5	1	0 6½		—	—	—	—
‡*	50	*Rhode I. Red.* Mrs. K. Earl, Grantstown House, Ballinakill, Co. Waterford.	February	295	4 8	4 12	21	7	6	22	25	24	18	13	16	12	13	22	5	129	65	199	26	27 2¼	(a) 987	—	—	5	—
			,,	296	4 7	4 12	20	6	21	22	23	22	22	24	19	12	10	16	35	141	41	217	45	30 8½	lbs. ozs. dr.	1	—	1	Sept.
			,,	297	4 8	4 8	14	10	11	21	22	20	22	25	20	20	11	22	—	103	115	218	9	27 9¾	(b) 123 14 2	1	—	1	Aug.
			March	298	4 6	—	18	7	—	—	—	—	—	—	—	—	—	—	—	—	25	25	—	4 9½	ozs.	1	25/11/30	—	—
			February	299	4 7	—	13	10	17	19	17	4	—	—	—	—	—	—	—	43	37	80	22	14 1¼	(c) 24·1	1	12/3/30	—	—
			,,	300	4 8	5 12	22	8	20	24	22	24	25	20	16	23	23	21	8	226	14	248	51	36 2¾	(d) £7 0 10	—	—	—	Nov., Aug.
‡*	39	*Rhode I. Red.* Mrs. M. King, Beech Grove, Donadea, Co. Kildare.	21.3.29	229	4 8	5 12	5	13	23	18	14	17	24	22	17	13	14	19	6	120	73	199	28	27 5	(a) 959	—	—	2	July
			8.3.29	230	4 8	—	23	23	23	20	18	5	—	—	—	—	—	—	28	76	8	112	69	22 3¼	lbs. ozs. dr.		24/3/30	—	—
			,,	231	5 0	6 4	—	16	20	19	26	26	25	22	—	—	—	—	24	78	52	154	41	21 5¼	(b) 123 5 3	—	—	—	—
			,,	232	4 12	6 8	18	22	22	21	20	21	21	21	3	22	15	22	2	88	138	228	47	32 0¾	ozs.	1	—	—	July
			,,	233	4 12	—	—	15	8	16	14	15	21	22	16	3	—	—	98	27	5	130	24	18 0	(c) 24·7	—	13/8/30	—	July
			,,	234	5 0	6 8	4	16	—	—	14	17	17	17	12	15	12	12	22	99	15	136	16	18 2¾	(d) £6 19 5	1	—	6	Aug.

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs).
‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

U.T. = Untrapped.

SECTION III.—SITTING BREEDS (OTHER THAN WHITE WYANDOTTE).—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
‡	55	*Light Sussex.*	3/3/29	325	5 8	7 12	18	10	—	4	23	14	14	12	6	5	1	—	66	41	—	107	28	15 7¼	(a) 884	—	—	3	Dec., Aug,
		Mr. F. C. Bernard, Belfield,	,,	326	5 0	6 0	16	—	20	21	19	18	18	13	17	11	11	11	68	104	3	175	40	25 7¼	lbs. ozs. dr. (b) 119 4 8	—	—	4	Oct., June. Aug.
		Stillorgan Rd.,	,,	327	5 12	8 0	18	3	—	—	—	—	—	—	—	—	—	—	—	20	1	21	20	4 9	ozs.	—	—	1	Aug.
		Ballsbridge,	,,	328	5 12	7 0	18	19	13	16	14	17	21	11	16	11	13	11	126	51	3	180	52	28 2¼	(c) 25·9	—	—	1	Aug.
		Dublin.	,,	329	5 8	6 0	19	25	23	20	23	23	22	17	16	17	17	19	6	156	79	241	27	35 2½	(d) £6 14 5¾	—	—	—	Aug.
			,,	330	5 0	3 4	—	26	22	20	17	18	20	18	11	6	—	—	76	80	2	158	53	24 10½		—	—	—	Nov., July
				U.T.	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	2	—	2	—	0 3					
‡	51	*Rhode I. Red.*	Feb. & March	301	5 0	5 12	20	20	15	17	20	20	21	13	—	—	—	5	2	111	38	151	33	23 6	(a) 888	—	—	—	—
		Mrs. D. Chearnley,	,,	302	4 12	6 4	—	14	16	12	12	6	13	11	16	—	—	—	25	73	2	100	32	15 6¾	lbs. ozs. dr.	—	—	—	—
		Salterbridge,	,,	303	5 0	—	—	—	—	9	20	3	—	—	—	—	—	—	6	24	2	32	—	4 1¼	(b) 116 5 5	—	12/3/30	—	Oct.
		Cappoquin,	,,	304	4 6	5 8	—	1	24	23	21	22	24	24	24	26	21	18	46	174	8	228	27	30 10	ozs.	—	—	—	—
		Co. Waterford.	,,	305	4 6	5 4	10	19	8	6	20	18	17	22	21	21	18	17	19	153	25	197	28	27 10¾	(c) 25·2	—	—	—	Aug.
			,,	306	5 12	6 12	19	12	—	18	21	15	22	18	9	17	20	8	40	114	25	179	15	25 4½	(d) £6 7 4¾	1	—	2	Sept.
				U.T.	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	1	—	0 1½					
‡	131	*Australorp.*	March	749	4 4	5 4	—	2	20	8	14	26	28	26	27	24	25	24	5	190	29	224	24	28 11¼	(a) 842	—	—	—	Oct., Aug.
		Mrs. S. J. Gabbett,	,,	750	4 8	5 8	—	20	16	—	20	23	23	18	17	7	20	18	119	60	3	182	35	26 1½	lbs. ozs. dr.	—	—	2	July
		Ballaghtobin,	,,	751	5 0	—	—	8	21	11	—	—	—	—	—	—	—	—	9	25	6	40	29	8 8	(b) 110 4 6	—	31/1/30	—	—
		Callan,	,,	752	4 12	—	24	23	5	9	—	—	—	—	—	—	—	—	2	48	11	61	47	13 11½	ozs.	—	31/1/30	—	—
		Co. Kilkenny.	,,	753	5 0	5 8	11	2	1	7	10	7	24	26	23	24	22	20	21	119	37	177	18	22 6¼	(c) 25·1	—	—	—	Aug.
			,,	754	5 0	4 12	21	13	6	3	7	5	16	17	19	21	10	20	32	93	33	158	31	23 0	(d) £6 3 2½	—	—	1	Oct., Aug.
‡*	49	*Rhode I. Red.*	29/4/29	289	5 8	—	1	13	—	—	—	3	—	—	—	—	—	—	—	7	10	17	7	3 6	(a) 903	—	22/3/30	—	Jan.
		Rev. Bro. Dominic,	,,	290	4 12	7 0	—	—	4	12	16	22	16	10	13	6	4	19	5	93	24	122	1	14 7¼	lbs. ozs. dr.	—	—	6	Sept.
		Agricultural Coll.,	,,	291	5 8	7 0	14	18	6	15	20	16	21	16	21	19	21	5	12	74	106	192	3	25 6¼	(b) 114 0 7	—	—	3	July, Sept.
		Mountbellew,	,,	292	5 0	6 4	—	14	18	14	18	23	23	13	10	18	18	17	23	119	44	186	9	25 ¼	ozs.	—	—	3	July
		Co. Galway.	,,	293	5 0	6 12	4	11	18	19	20	22	27	19	20	20	23	19	6	181	35	222	27	30 4½	(c) 24·2	—	—	—	Aug.
			,,	294	5 8	6 8	1	13	11	—	12	24	24	16	12	21	13	17	10	112	42	164	25	21 4¾	(d) £6 0 8¾	—	—	4	Dec., Aug.

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs).

‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

U.T. = Untrapped.

SECTION III.—SITTING BREEDS (OTHER THAN WHITE WYANDOTTE).—*continued*.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
‡	52	*Rhode I. Red.*	March	307	4 8	5 8	—	—	—	—	3	17	26	24	23	23	22	21	6	148	5	159	—	18 10¾	(a) 576	—	—	—	Nov.
		Mrs. E. M. O'Flynn,	,,	308	4 8	6 0	9	21	22	21	14	21	23	16	15	8	10	21	114	87	—	201	58	31 5	lbs. ozs. dr.	—	—	1	June
		Prohurst,	,,	309	4 7	—	—	6	21	19	1	—	—	—	—	—	—	—	—	37	10	47	23	9 5¾	(b) 77 6 10	—	11/2/30	—	Oct.
		Milford,	,,	310	4 12	5 4	18	10	—	—	—	12	16	11	10	11	22	19	32	95	2	129	27	19 2¼	ozs.	1	—	—	Jan.
		Charleville,	,,	311	4 8	—	14	15	—	—	—	—	—	—	—	—	—	—	5	23	1	29	28	7 3	(c) 25·8	—	10/12/29	—	—
		Co. Cork.	,,	312	5 0	—	—	—	—	9	2	—	—	—	—	—	—	—	1	9	1	11	—	1 9¼	(d) £4 8 0	—	11/2/30	—	Nov.
†‡*	40	*Rhode I. Red.*	7/3/29	235	5 4	6 8	21	12	—	18	26	23	27	13	26	14	15	24	2	13	204	219	7	25 1½	(a) 551	13	—	3	Dec., Aug.
		Mrs. G. Eyre-Studdert,	,,	236	5 0	—	21	10	—	—	—	—	—	—	—	—	—	—	—	16	15	31	16	6 8¾	lbs. ozs. dr.	—	26/11/29	—	—
			,,	237	5 2	5 8	11	2	9	6	21	7	3	13	6	10	12	16	—	1	115	116	—	13 2¼	(b) 66 3 8	63	—	5	—
		Cragmoher,	,,	238	5 0	—	21	10	—	—	—	—	—	—	—	—	—	—	2	25	4	31	27	7 2½	ozs.	—	26/11/29	—	—
		Corofin,	,,	239	5 4	5 4	—	—	—	—	22	23	21	16	10	11	11	13	59	64	4	127	—	14 9¼	(c) 23·1	—	—	6	Aug.
		Co. Clare.	,,	240	5 0	—	18	9	—	—	—	—	—	—	—	—	—	—	—	3	24	27	3	5 5¼	(d) £3 12 5½	1	28/11/29	—	—

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.

† Disqualified under Clause 19 (eggs failed to reach-standard weight of 24 ozs. per dozen).

‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

SECTION IV.—NON-SITTING BREEDS (STATION HOLDERS).

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
1	70	*White Leghorn.*	20/3/29	415	3 14	5 0	6	24	2	10	23	24	16	13	12	15	16	13	133	38	3	174	29	24 11¼	(a) 1,163	—	—	1	Nov.
		Mrs. M. Wallace,	,,	416	3 12	4 0	5	—	—	—	20	20	23	23	20	18	18	19	36	116	14	166	—	19 8¼	lbs. ozs. dr.	1	—	—	Oct.
		Camlin,	,,	417	4 0	4 0	11	17	18	19	19	19	24	22	22	21	19	15	93	131	2	226	50	33 2½	(b) 158 1 1	—	—	—	Aug.
		Roscrea,	,,	418	3 8	4 0	—	—	—	—	21	11	25	24	26	23	21	18	12	143	14	169	—	19 10½	ozs.	—	—	—	Nov.
		Co. Tipperary.	,,	419	3 12	3 12	10	15	15	13	17	22	23	21	22	16	15	—	83	103	3	189	39	27 4	(c) 26·1	—	—	—	July
			,,	420	3 8	4 4	16	16	19	22	21	20	20	23	23	21	20	18	61	172	6	239	51	35 7¼	(d) £8 0 7¾	—	—	—	—
2	58	*White Leghorn.*	March	343	3 14	3 8	14	19	—	7	13	23	21	23	18	19	13	—	85	80	5	170	30	24 0½	(a) 1,149	—	—	—	July
		Miss A. Fitzgerald,	,,	344	3 8	4 4	—	11	16	16	21	21	21	11	22	22	4	—	3	121	41	165	17	21 10½	lbs. ozs. dr.	—	—	1	Aug.
		Ardgoul,	,,	345	3 8	4 8	13	15	16	20	19	18	23	21	22	20	18	15	12	174	34	220	29	31 3½	(b) 149 14 4	—	—	—	Aug.
		Rathkeale,	,,	346	3 10	3 4	12	21	17	21	20	20	22	19	20	21	7	—	64	109	27	200	29	29 5	ozs.	—	—	—	July
		Co. Limerick.	,,	347	3 12	3 12	—	16	19	18	20	24	20	20	20	17	15	11	34	143	23	200	21	27 8¼	(c) 25·0	—	—	—	July
			,,	348	3 8	5 4	—	7	17	18	22	21	23	19	20	13	11	23	23	106	65	194	6	24 10½	(d) £7 19 2¼	—	—	1	July
†*	69	*White Leghorn.*	5/3/29	409	4 4	—	18	14	—	—	14	6	—	—	—	—	—	—	16	32	4	52	28	9 8	(a) 1.168	—	14/3/30	—	Dec.
		Miss M. E. Anglim,	22/3/29	410	4 0	4 4	23	18	21	16	21	22	25	22	24	22	18	22	2	177	75	254	23	35 8¾	lbs. ozs. dr.	—	—	—	—
		Farranaleen,	5/3/29	411	3 12	4 0	14	21	18	21	22	14	16	13	17	20	15	14	2	4	199	205	—	26 2¼	(b) 145 2 10	29	—	—	June, Aug.
		Fethard,	,,	412	5 0	5 8	19	20	3	14	18	20	24	25	25	22	22	12	141	80	3	224	46	32 3¼	ozs.	—	—	—	July
		Co. Tipperary.	,,	413	4 0	3 12	17	—	—	7	23	23	26	25	21	19	22	20	—	85	118	203	4	22 11½	(c) 23·9	—	—	—	Nov., July
			17/3/29	414	4 0	4 4	21	20	18	14	20	20	21	19	22	16	25	14	2	56	172	230	2	29 8¾	(d) £7 16 6½	—	—	—	Dec., July
3	68	*White Leghorn.*	1/4/29	403	3 7	3 8	17	2	2	18	19	9	22	14	15	19	16	2	21	110	24	155	13	20 10¾	(a) 1,119	—	—	—	Oct., July
		Miss M. O'Brien,	,,	404	3 8	4 12	10	15	16	—	12	18	19	19	20	19	20	14	45	133	4	182	40	26 6½	lbs. ozs. dr.	—	—	—	—
		Philipstown Cott.,	,,	405	4 2	5 12	2	11	16	14	17	20	22	20	15	14	10	9	136	32	2	170	31	23 11¼	(b) 147 5 0	—	—	—	May, July
		Cappawhite,	,,	406	3 12	4 4	11	19	20	15	20	21	23	24	18	20	3	—	8	141	45	194	49	28 0¼	ozs.	—	—	—	July
		Co. Tipperary.	,,	407	4 4	5 0	8	9	18	18	3	19	24	24	23	24	21	21	4	117	91	212	36	27 6¾	(c) 25·3	—	—	—	—
			,,	408	3 12	4 4	20	7	—	11	18	22	21	20	22	22	24	19	27	162	17	206	18	27 8¼	(d) £7 14 7¾	1	—	—	Nov., Aug.
4	65	*White Leghorn.*	March	385	3 6	4 0	20	18	—	—	21	25	26	26	23	25	23	11	8	200	10	218	35	30 2¾	(a) 1,135	—	—	—	Dec.
		Mrs. M. Kelleher,	,,	386	3 8	4 0	13	5	—	5	9	23	22	27	25	24	21	13	2	150	35	187	16	23 5¾	lbs. ozs. dr.	—	—	—	Oct., Aug.
		Shanakeil House,	,,	387	3 4	3 2	12	3	—	—	5	20	25	22	21	21	20	—	7	116	26	149	13	18 4	(b) 147 0 5	—	—	—	Oct., Aug.
		Kilcorney,	,,	388	3 7	4 0	18	9	—	10	13	23	24	23	23	22	22	23	11	180	19	210	27	28 2½	ozs.	—	—	—	Dec., Aug.
		Banteer,	,,	389	3 8	4 8	—	20	—	1	14	18	21	21	22	19	19	16	83	87	1	171	19	23 1¼	(c) 24·9	—	—	—	Dec., Aug.
		Co. Cork.	,,	390	3 4	3 12	13	15	18	10	20	23	21	24	18	20	15	—	4	149	44	197	41	27 10	(d) £7 11 7½	—	—	—	Aug.
				U.T.	—	—	—	—	—	1	1	—	—	—	—	—	—	1	1	2	—	3	—	0 5¼					

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.

† Disqualified under Clause 19 (eggs failed to reach standard weight of 24 ozs. per dozen).

SECTION IV.—NON-SITTING BREEDS (STATION HOLDERS)—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
*	62	*White Leghorn.*	7/4/29	367	3 12	4 8	3	20	18	—	5	20	21	24	23	10	19	17	7	158	15	180	28	25 7¼	(a) 1,088	—	—	—	July
		Mrs. M. E. Higgins,	,,	368	3 8	4 8	10	19	18	16	1	21	20	21	20	11	20	20	137	60	—	197	53	30 4¼	lbs. ozs. dr.	—	—	—	—
		Carramarla Lodge,	,,	369	3 8	4 8	2	20	21	19	9	22	23	22	23	17	8	—	1	79	106	186	22	24 8	(b) 139 1 14	—	—	—	Aug.
		Claremorris,	,,	370	3 6	3 12	10	19	2	11	21	23	22	23	23	19	19	17	2	110	97	209	4	26 10½	ozs.	—	—	—	Dec., Aug.
		Co. Mayo.	,,	371	3 7	5 4	—	—	—	20	13	22	22	22	24	15	16	11	16	135	14	165	4	20 0¾	(c) 24·6	—	—	—	—
			,,	372	3 6	4 8	10	17	—	—	12	4	23	18	19	22	21	5	2	45	104	151	9	18 4½	(d) £7 5 11¼	1	—	—	—
5	59	*White Leghorn.*	April	349	4 0	4 2	5	18	2	—	16	16	23	22	21	21	21	17	65	115	2	182	25	25 1¼	(a) 1,041	—	—	—	—
		Mrs. H. O'Sullivan,	March	350	3 10	4 0	6	9	—	15	21	10	23	25	24	28	24	13	19	140	39	198	13	25 3¾	lbs. ozs. dr.	—	—	—	—
		Kiltanna,	,,	351	3 8	4 0	11	12	13	19	18	24	22	21	20	17	19	17	60	148	5	213	41	30 5¾	(b) 142 0 14	1	—	—	Aug.
		Knockaderry,	,,	352	3 8	3 8	14	10	—	5	22	21	26	24	20	21	22	14	26	164	9	199	19	26 6½	ozs.	—	—	—	Dec.
		Newcastle West,	February	353	4 4	5 0	16	2	6	11	18	19	24	22	14	20	12	14	130	48	—	178	29	24 4¾	(c) 26·2	—	—	2	July
		Co. Limerick.	,,	354	3 8	—	10	9	10	15	21	6	—	—	—	—	—	—	48	19	4	71	26	12 4¼	(d) £7 4 2¾	—	18/3/30	—	Nov.
*	61	*White Leghorn.*	17/4/29	361	3 8	4 4	—	9	18	14	—	19	23	25	24	22	22	22	5	154	39	198	14	26 4¼	(a) 1,042	—	—	—	Aug.
		Sister-inCharge,	,,	362	3 7	4 4	19	5	8	20	18	21	22	19	21	20	18	—	17	116	58	191	9	25 1¾	lbs. ozs. dr.	2	—	—	Aug.
		Technical School,	,,	363	3 7	4 6	12	10	5	19	21	23	22	21	20	21	22	18	1	140	73	214	2	27 6½	(b) 132 8 1	3	—	—	—
		Swinford	,,	364	3 7	4 4	6	4	—	6	4	—	—	—	—	—	—	—	6	5	9	20	6	4 0¾	ozs.	29	—	—	June
		Co. Mayo.	,,	365	3 6	4 2	11	9	1	8	16	20	22	22	22	24	20	14	16	153	20	189	6	24 6¼	(c) 24·4	1	—	—	—
			,,	366	3 7	4 12	22	17	4	4	20	22	23	27	26	21	22	17	26	164	35	225	18	30 9½	(d) £6 18 11¾	—	—	—	Aug.
				U.T.			1	—	—	—	—	—	1	—	1	1	1	—	—	3	2	5	—	0 6¾					
‡	64	*White Leghorn.*	April	379	3 8	4 0	14	5	—	5	21	21	22	25	24	23	22	18	33	150	17	200	8	25 10	(a) 939	—	—	—	Aug.
		Mrs. C. Mulcahy,	,,	380	3 8	—	5	15	17	3	—	—	—	—	—	—	—	—	26	14	—	40	40	9 5½	lbs. ozs. dr.	—	17/1/30	—	—
		Ballinahown,	,,	381	3 10	4 0	8	14	—	10	19	21	20	24	25	23	23	22	73	124	12	209	13	28 1	(b) 122 6 3	—	—	—	—
		Ardagh,	,,	382	3 7	3 12	6	20	19	4	14	23	26	24	25	23	24	20	7	199	22	228	43	32 5	ozs.	—	—	—	July
		Co. Limerick.	,,	383	3 7	3 12	16	16	19	4	14	21	22	22	22	23	18	20	25	183	9	217	49	31 9¼	(c) 25·0	—	—	—	July
			,,	384	3 8	—	7	16	16	5	—	—	—	—	—	—	—	—	—	37	7	44	37	10 1½	(d) £6 17 9¾	—	20/1/30	—	—
				U.T.			—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	1	—	0 1½					
‡	72	*Black Minorca.*	18/2/29	427	3 8	4 4	11	2	—	6	15	19	22	22	21	21	21	20	114	66	—	180	13	23 6¼	(a) 866	—	—	—	Aug.
		Mrs. R. Cochrane,	25/3/29	428	3 12	4 12	5	23	19	6	13	23	24	26	24	18	8	20	48	153	8	209	48	30 6	lbs. ozs. dr.	—	—	—	Aug.
		Tullyroe,	,,	429	3 8	4 8	18	21	14	—	19	24	26	23	18	24	25	24	31	191	14	236	44	34 7	(b) 119 1 8	—	—	—	—
		Tremane,	,,	430	4 0	—	14	20	17	8	—	—	—	—	—	—	—	—	30	29	—	59	56	13 8½	ozs.	—	22/1/30	—	—
		Co. Roscommon.	,,	431	3 8	5 0	—	4	13	6	2	22	12	15	14	15	13	6	105	17	—	122	20	16 7½	(c) 26·4	—	—	4	Sept.
			,,	432	3 8	—	19	20	18	3	—	—	—	—	—	—	—	—	49	10	1	60	59	14 2	(d) £6 13 1¾	—	24/1/30	—	—

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.
‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

SECTION IV.—NON-SITTING BREEDS (STATION HOLDERS)—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting
‡*	71	*White Leghorn.*	25/4/29	421	3 7	4 4	16	10	—	19	22	25	24	25	24	19	22	18	3	135	86	224	3	s. d. 28 4½	(a) 994	1	—	—	Nov., July
		Mrs. M. A. Walsh,	5/4/29	422	3 6	—	5	8	—	—	—	—	—	—	—	—	—	—	1	4	8	13	5	2 10½	lbs. ozs. dr.	—	3/12/29	—	—
		Wardstown,	,,	423	3 8	3 12	20	10	—	8	20	21	25	27	27	24	21	18	6	88	127	221	14	26 7¼	(b) 125 9 8	—	—	—	Dec., Aug.
		Athboy,	,,	424	3 8	4 8	1	19	—	6	21	16	25	23	24	23	20	23	38	149	14	201	19	26 11½	ozs.	—	—	—	Dec., Aug.
		Co. Meath.	,,	425	3 6	4 0	17	13	—	12	22	26	28	26	25	26	22	22	3	184	52	239	7	30 8¾	(c) 24·0	—	—	—	Nov., July
			25/4/29	426	3 8	5 0	8	7	4	11	13	19	24	8	—	—	2	—	6	69	21	96	9	12 9¼	(d) £6 8 3¼	4	—	—	Aug.
†‡*	60	*White Leghorn.*	April	355	3 12	4 12	9	1	9	19	3	13	13	21	2	—	—	—	11	59	20	90	11	12 6¼	(a) 861	—	—	—	—
		Mrs. S. Cormac,	March	356	3 8	4 8	15	3	7	20	23	22	21	3	—	—	—	—	22	66	26	114	13	15 10¼	lbs. ozs. dr.	—	—	—	Nov., July
		Ballykerin,	April	357	3 8	4 0	11	1	—	—	19	21	20	22	19	19	—	7	8	119	12	139	4	16 8½	(b) 106 14 4	—	—	—	Nov.
		Ballincurry,	,,	358	3 12	4 0	15	3	—	6	24	25	26	25	25	22	22	1	3	95	96	194	3	22 4½	ozs.	—	—	—	Dec.
		Thurles,	,,	359	3 8	3 12	16	—	1	20	20	20	24	21	22	7	17	11	2	21	156	179	—	19 7½	(c) 23·8	—	—	—	Nov., Aug.
		Co. Tipperary.	,,	360	3 10	—	11	—	9	—	9	23	21	21	22	20	8	—	4	65	75	144	11	16 8¼	(d) £5 3 10½	—	4/9/30	—	—
				U.T.			—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	1	—	0 1¼					
‡	66	*White Leghorn.*	10/4/29	391	3 6	—	7	12	16	—	15	20	23	14	—	—	—	—	2	73	32	107	22	15 1½	(a) 676	—	24/6/30	—	Jan.
		Miss L. Gould,	,,	392	3 8	5 0	16	11	—	21	19	22	22	20	24	22	24	24	44	164	17	225	31	31 4	lbs. ozs. dr.	1	—	—	Dec., Aug.
		Derryhoo,	,,	393	3 8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(b) 89 3 15	—	12/11/30	—	—
		Milltown,	,,	394	3 8	—	9	22	15	10	—	—	—	—	—	—	—	—	3	44	9	56	44	12 10¾	ozs.	—	25/1/30	—	—
		Belturbet,	,,	395	3 8	4 12	12	21	—	—	17	20	24	22	23	24	22	22	81	125	1	207	32	29 3½	(c) 25·3	—	—	—	Dec.
		Co. Cavan.	,,	396	3 6	—	1	23	16	6	17	18	—	—	—	—	—	—	1	44	36	81	16	13 6¼	(d) £5 2 2	—	8/8/30	—	—

* Disqualified under Clause 21 (more than 20 per cent. second grade aggs). U.T. = Untrapped.

† Disqualified under Clause 19 (eggs failed to reach standard weight of 24 ozs. per dozen).

‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

SECTION V.—WHITE WYANDOTTE (STATION HOLDERS).

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight.		Eggs Laid.												Eggs per Pullet.					Value per Pullet.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
					On Arrival. lb. ozs.	At Close of Test lb. ozs.	16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	s. d.					
*	87	Mrs. J. M. Walsh,	27/2/29	517	4 8	5 0	24	25	21	22	21	24	24	21	12	24	20	21	—	18	241	259	3	33 1	(a) 1,276.	—	—	—	—
		Ballyvoreen Ho.,	,,	518	4 6	5 0	16	13	23	22	24	26	18	20	17	14	14	16	4	153	66	223	31	31 7¾	lbs. ozs. dr.	2	—	4	July
		Murroe,	,,	519	4 8	5 0	13	22	19	17	19	23	12	18	11	13	11	17	—	122	73	195	38	28 8¼	(b) 163 7 10	3	—	5	Aug.
		Co. Limerick.	,,	520	5 0	6 4	13	19	19	19	18	20	19	19	15	17	19	15	135	74	3	212	52	32 7	ozs.	—	—	1	—
			,,	521	4 14	5 12	6	23	23	22	24	22	24	20	22	15	17	19	54	173	10	237	58	35 4½	(c) 24·6	—	—	2	July
			,,	522	4 8	5 8	15	22	19	16	19	18	16	5	5	1	—	14	22	119	9	150	56	24 11	(d) £9 6 3½	—	—	—	June
1	78	Mrs. M. Drohan,	21/3/29	463	5 4	5 12	16	22	5	19	14	6	27	14	11	13	12	8	94	72	1	167	49	26 3¾	(a) 1,188	—	—	4	July
		Ballynevin,	,,	464	4 12	4 12	20	20	19	19	17	21	19	16	15	16	12	12	19	146	41	206	38	30 11¾	lbs. ozs. dr.	—	—	—	July
		Carrick-on-Suir,	,,	465	4 8	4 4	16	18	15	13	14	17	20	20	16	19	19	13	10	178	12	200	48	30 0¼	(b) 160 7 13	—	—	—	July
		Co. Waterford.	,,	466	4 12	5 12	21	16	19	16	21	18	22	15	15	17	7	17	11	165	28	204	32	30 6½	ozs.	—	—	2	Oct., July
			,,	467	5 0	5 4	21	18	14	13	18	15	20	17	13	6	14	14	120	62	1	183	53	28 6¼	(c) 25·9	—	—	—	June
			,,	468	5 0	5 8	12	22	21	21	22	25	22	24	8	18	21	12	190	38	—	228	61	34 11¾	(d) £9 1 4¼	—	—	1	Oct., July
*	82	Mrs. M. Colleran,	March	487	4 8	5 8	17	23	23	23	21	20	20	20	19	18	16	3	152	67	4	223	67	35 1½	(a) 1,278	—	—	—	Aug.
		Cranaghmore,	,,	488	4 8	4 4	24	23	20	20	22	21	17	22	15	7	13	17	18	41	162	221	6	30 5½	lbs. ozs. dr.	—	—	4	Oct., Aug.
		Athlone,	,,	489	4 12	5 0	6	19	18	21	22	22	24	22	21	16	11	8	1	39	170	210	8	26 3¾	(b) 159 6 11	5	—	—	July
		Co. Roscommon.	,,	490	4 12	5 4	21	22	11	23	20	23	21	18	10	16	10	21	—	129	87	216	19	30 11½	ozs.	1	—	2	Sept.
			,,	491	4 8	5 12	8	26	23	24	24	23	25	23	24	19	21	18	3	169	86	258	50	36 6¼	(c) 24·0	—	—	—	Sept.
			,,	492	5 4	5 8	7	12	16	10	19	16	18	10	13	11	13	5	1	7	142	150	—	18 0½	(d) £8 17 5	18	—	1	July
2	83	Mrs. K. Newman,	February	493	4 7	4 12	16	16	19	21	23	23	24	14	23	9	7	26	54	159	8	221	58	33 1½	(a) 1,185	—	—	3	June
		Drinadaly,	,,	494	4 12	5 12	25	5	—	4	23	21	19	15	14	13	13	19	6	123	42	171	23	22 8½	lbs. ozs. dr.	—	—	6	July
		Trim,	,,	495	5 0	—	22	17	17	12	17	20	21	14	—	—	—	—	25	110	5	140	56	23 0¾	(b) 159 14 12	—	22/5/30	—	—
		Co. Meath.	,,	496	5 0	5 0	14	2	23	19	18	24	17	17	15	19	15	21	23	164	17	204	39	29 7½	ozs.	—	—	4	July
			,,	497	4 8	5 4	13	20	20	21	20	23	23	14	16	21	17	23	174	54	3	231	59	35 4½	(c) 25·9	—	—	3	Oct.
			,,	498	4 8	5 12	2	21	23	18	20	24	17	19	16	18	21	18	136	79	2	217	50	32 6¼	(d) £8 16 6¼	—	—	2	July
				U.T.			—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	1	—	0 1¼					
*	80	Mrs. M. Hand,	12/3/29	475	4 8	5 0	21	22	21	24	22	23	25	22	21	22	16	16	—	147	108	255	24	35 11½	(a) 1,233	—	—	—	Aug.
		Berries Hill,	,,	476	4 8	5 6	6	18	18	18	19	21	22	23	17	12	17	20	23	144	44	211	13	29 8	lbs. ozs. dr.	—	—	1	June
		Athlone,	,,	477	4 6	5 12	—	11	20	22	18	24	26	17	23	21	24	18	2	12	210	224	9	25 8½	(b) 160 12 13	15	—	—	July
		Co. Roscommon.	,,	478	4 8	5 8	18	16	16	18	2	20	24	25	22	20	19	19	—	75	144	219	17	28 9½	ozs.	—	—	—	Aug.
			,,	479	4 8	—	17	23	20	4	11	—	—	—	—	—	—	—	1	54	20	75	47	15 10	(c) 25·0	—	18/3/30	—	—
			,,	480	4 8	4 8	21	20	23	19	22	25	24	22	19	10	21	23	1	138	110	249	14	34 10	(d) £8 10 9½	—	—	—	June

*Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.

STATION V.—WHITE WYANDOTTE (STATION HOLDERS).—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
3	73	Miss A. Donegan,	1/3/29	433	5 0	6 0	14	17	17	16	17	20	18	17	14	17	20	16	44	157	2	203	50	31 0¼	(a) 1,038	—	—	—	July
		Monasterboice,	,,	434	4 8	—	—	21	16	11	—	—	—	—	—	—	—	—	16	31	1	48	39	10 11¼	lbs. ozs. dr.	—	12/2/30	—	—
		Drogheda,	,,	435	5 0	5 8	—	13	19	19	22	22	23	21	23	20	21	20	106	109	8	223	30	31 3½	(b) 140 4 15	1	—	—	July
		Co. Louth.	,,	436	4 12	6 0	13	15	18	20	20	19	21	11	16	13	13	19	19	173	6	198	49	30 1¾	ozs.	1	—	3	July
			16/3/29	437	4 4	5 0	5	22	16	19	21	17	22	14	14	20	18	21	21	174	14	209	42	30 11¼	(c) 25·9	2	—	2	June
			1/3/29	438	4 12	7 0	—	12	19	20	18	21	20	16	11	7	6	7	126	28	3	157	37	22 8¼	(d) £7 17 0¼	—	—	—	June
4	79	Mrs. M. Hanrahan,	March	469	4 8	5 8	—	—	5	20	18	22	7	15	10	5	13	15	3	99	28	130	3	16 6¾	(a) 1,125	1	—	4	July
		Ardreigh,	,,	470	5 4	5 8	11	4	17	17	19	26	23	22	17	13	21	17	177	30	—	207	36	29 4¾	lbs. ozs. dr.	—	—	—	Sept.
		Urlingford,	,,	471	5 0	7 0	—	11	22	22	21	18	25	17	16	16	18	17	174	28	1	203	38	29 3¾	(b) 158 14 2	—	—	4	July
		Co. Kilkenny.	,,	472	4 8	7 0	—	—	11	25	25	20	23	23	7	21	17	20	183	9	—	192	18	25 4½	ozs.	—	—	1	Sept.
			,,	473	4 8	5 12	—	—	19	15	21	27	19	26	21	10	14	9	2	142	37	181	17	22 6½	(c) 27·1	—	—	3	Oct., July
			,,	474	4 14	4 8	19	10	25	23	25	21	22	11	15	8	17	15	29	173	9	211	54	32 6½	(d) £7 15 10¼	—	—	1	July
				U.T.			—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	1	—	0 1½					
5	77	Mrs. M. Byrne,	February	457	4 8	5 4	20	25	19	26	16	18	13	15	16	10	10	14	28	121	47	196	64	30 10¾	(a) 1,034	—	—	—	June
		Knockbutton,	,,	458	4 8	—	3	—	—	—	—	—	—	—	—	—	—	—	—	3	—	3	3	0 8¼	lbs. ozs. dr.	—	30/10/30	—	—
		Windgap,	,,	459	4 8	4 8	22	23	13	18	20	19	22	10	11	4	22	22	20	161	25	206	52	31 11	(b) 137 4 6	1	—	1	July
		Co. Kilkenny.	,,	460	4 10	4 8	23	23	21	18	21	22	24	22	6	23	7	25	15	210	10	235	72	36 4¾	ozs.	—	—	2	June
			,,	461	5 0	5 8	16	25	23	18	13	21	23	23	16	21	6	23	11	158	59	228	26	33 5¾	(c) 25·5	2	—	2	June
			,,	462	4 8	6 0	—	—	12	20	20	22	25	27	23	3	9	4	159	5	1	165	17	20 11½	(d) £7 14 5¼	—	—	1	Oct., July
				U.T.			—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	1	—	0 1¼					
*	81	Mrs. J. Lehane,	14/2/29	481	5 0	5 8	15	20	22	21	22	26	26	23	14	23	23	12	6	123	118	247	7	33 5½	(a) 1,066	3	—	1	July
		Crossmahon,	,,	482	4 12	—	10	4	—	9	23	16	—	—	—	—	—	—	1	53	8	62	12	9 1¾	lbs. ozs. dr.	1	8/4/30	—	Oct.
		Lissarda,	,,	483	4 12	4 12	18	7	21	19	19	17	22	21	18	13	18	14	—	8	199	207	—	24 10½	(b) 135 14 10	16	—	—	June
		Co. Cork.	,,	484	5 0	5 4	9	4	22	18	16	22	22	16	12	12	—	3	76	74	6	156	35	22 6¼	ozs.	—	—	4	Sept.
			,,	485	5 0	5 4	21	4	—	8	23	22	23	23	22	10	16	17	43	134	12	189	18	25 0¼	(c) 24·5	—	—	—	Oct., July
			19/1/29	486	5 4	5 8	12	16	14	6	22	19	21	21	19	21	22	10	55	142	6	203	42	29 6¾	(d) £7 5 0	—	—	—	Sept.
				U.T.			—	1	—	—	—	—	—	—	—	—	1	—	1	1	—	2	1	0 5					
‡*	74	Miss M. Byrne,	—	439	4 8	5 0	2	—	9	11	17	9	21	17	19	11	18	13	—	55	92	147	—	16 4½	(a) 927	1	—	3	July
		Montivideo,	—	440	4 8	5 4	11	8	20	20	15	24	16	19	11	13	23	14	23	135	36	194	36	28 0½	lbs. ozs. dr.	2	—	6	Aug.
		Roscrea,	—	441	5 4	—	10	6	—	—	—	—	—	—	—	—	—	—	1	13	2	16	14	3 7½	(b) 121 2 15	—	26/11/29	—	—
		Co. Tipperary.	—	442	5 0	6 0	15	10	22	23	23	19	15	13	18	12	3	8	77	92	12	181	44	27 0½	ozs.	—	—	4	May,
			—	443	4 12	5 4	19	10	1	18	19	22	21	10	23	5	22	10	2	104	74	180	21	23 10¾	(c) 24·8	2	—	2	July
			—	444	5 6	4 8	14	20	19	17	18	20	23	21	18	18	12	18	88	129	1	218	58	33 4	(d) £6 12 5	—	—	1	June
				U.T.			—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	1	—	0 1½					

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs).

‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

U.T = Untrapped.

SECTION V.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
			9/2/29	445	4 12	—	—	1	2	—	—	—	—	—	—	—	—	—	—	2	1	3	2	0 8¾	(a) 838	—	8/7/30	—	—
‡	75	Miss J. O'Keeffe,	,,	446	4 7	5 8	6	20	21	23	21	23	25	25	21	21	22	23	—	191	60	251	52	35 4¾	lbs. ozs. dr.	1	—	—	July
		Ballybooden,	,,	447	4 6	5 0	19	22	20	17	18	21	20	18	16	12	15	14	42	150	20	212	48	32 5	(b) 108 13 6	—	—	—	Aug.
		Knocktopher,	,,	448	4 6	—	—	12	10	—	—	—	—	—	—	—	—	—	20	2	—	22	22	5 5¾	ozs.	—	23/1/30	—	—
		Co. Kilkenny.	,,	449	4 10	4 2	15	21	21	21	22	19	20	15	11	—	—	—	55	109	1	165	63	26 7¼	(c) 24·9	—	—	—	June
			,,	450	4 8	—	18	18	18	20	23	25	26	23	13	—	—	—	2	139	43	184	36	27 1	(d) £6 7 10¾	—	6/7/30	—	—
				U.T.			—	—	—	1	—	—	—	—	—	—	—	—	—	1	—	1	1	0 2¼					
‡*	84	Mrs. M. Nagle,	March	499	4 12	5 4	17	18	—	—	8	19	15	18	12	9	14	19	2	85	62	140	18	20 6½	(a) 854	—	—	2	June
		Springmount,	,,	500	4 10	5 4	11	17	11	—	—	—	—	—	—	—	—	—	—	7	32	39	7	7 11¼	lbs. ozs. dr.	—	—	—	June
		Mallow,	,,	501	4 7	5 0	19	21	20	18	19	18	4	—	—	—	—	—	1	46	72	119	24	19 9½	(b) 112 13 6	—	—	—	June
		Co. Cork.	,,	502	4 8	5 4	—	—	—	—	17	20	23	24	19	20	21	21	130	33	2	165	—	19 7¾	ozs.	—	—	—	Aug.
			,,	503	5 0	6 0	6	25	17	19	23	17	13	13	16	14	12	16	148	41	2	191	52	29 10	(c) 25·4	—	—	—	Aug.
			,,	504	4 8	4 12	22	6	22	21	22	13	20	18	11	5	13	14	19	114	54	187	36	27 5¼	(d) £6 5 8¾	—	—	6	June
				U.T.			—	—	—	1	1	—	—	—	—	1	1	—	1	2	1	4	—	0 6½					

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.
‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

SECTION VI.—SITTING BREEDS OTHER THAN WHITE WYANDOTTE (STATION HOLDERS).

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Ap.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade 16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
1	112	*Barred Rock.* Mrs. E. A. Henderson, Ardrum, Inniscarra, Co. Cork.	12/3/29	667	6 0	6 12	4	—	—	7	25	27	27	20	22	18	15	23	8	160	20	188	—	22 3	(a) 1,282 lbs. ozs. dr. (b) 170 11 0 ozs. (c) 25·6 (d) £8 15 2	—	—	3	Oct., Aug.
			12/3/29	668	5 14	7 0	9	—	20	21	25	25	25	19	13	25	14	22	30	171	17	218	31	29 3		1	—	3	Aug.
			21/3/29	669	6 0	7 12	16	22	23	19	22	21	26	18	21	18	5	—	49	153	9	211	58	32 3		—	—	—	Aug.
			12/3/29	670	6 0	7 4	23	21	18	7	17	15	27	26	22	18	18	21	47	174	12	233	58	35 0¾		—	—	—	July
			18/2/29	671	5 8	6 4	—	—	12	20	19	21	26	24	24	22	27	21	77	139	—	216	18	25 7¾		—	—	—	Oct.
			2/3/29	672	5 12	7 4	13	22	4	—	17	27	27	26	21	16	20	23	83	130	3	216	36	30 8½		—	—	3	Dec.
*	111	*Buff Rock.* Mrs. N. Ryan, Cluggin, House, Oola, Co. Limerick.	4/3/29	661	5 0	6 0	22	23	16	20	21	22	24	21	19	20	20	1	—	42	187	229	22	29 10¾	(a) 1,218 lbs. ozs. dr. (b) 159 0 8 ozs. (c) 25·1 (d) £8 14 3	—	—	2	Sept.
			,,	662	6 0	6 8	16	23	16	7	20	24	15	19	17	14	13	18	130	72	—	202	55	31 3½		—	—	6	Aug.
			,,	663	5 8	—	21	18	23	8	21	22	18	18	10	15	7	—	18	108	55	181	25	26 6¾		—	23/8/30	3	June
			,,	664	5 0	6 8	—	11	19	19	20	19	21	24	13	16	12	18	97	94	1	192	36	27 5½		—	—	2	Aug.
			,,	665	5 8	6 0	24	17	—	3	27	25	27	22	20	19	19	14	2	110	105	217	34	27 1½		1	—	—	Jan., Sept.
			,,	666	5 8	6 8	25	23	20	19	21	21	19	14	9	12	—	13	97	99	—	196	74	31 9¾		—	—	—	Sept.
				U.T.	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	—	1	—	0 1¼					
2	93	*Rhode I. Red.* Mrs. M. Doyle, Coolmanagh, Hacketstown, Co. Carlow.	4/2/29	553	4 7	5 4	19	15	3	4	16	24	25	23	20	5	25	20	23	170	6	199	34	28 5¾	(a) 1,206 lbs. ozs. dr. (b) 168 7 10 ozs. (c) 26·8 (d) £8 8 10¼	—	—	1	Dec., Sept.
			,,	554	5 4	6 8	13	18	17	12	19	20	23	20	12	7	17	23	158	42	1	201	49	30 6		1	—	2	—
			28/2/29	555	4 8	6 0	17	16	12	9	19	24	22	17	21	22	11	17	92	111	4	207	47	30 7¾		—	—	2	Aug.
			,,	556	5 0	6 8	—	—	7	12	21	21	23	23	22	22	19	24	165	29	—	194	10	24 6		—	—	—	—
			,,	557	5 0	6 4	15	19	5	8	24	24	25	25	19	24	15	16	69	137	13	219	36	30 9½		—	—	2	July
			,,	558	4 6	6 4	—	1	11	12	2	23	27	24	24	19	22	21	116	68	2	186	15	23 11¼		—	—	—	Aug.
*	99	*Rhode I. Red.* Mrs. E. Nugent, Clonkeefy, Ballyjamesduff, Co. Cavan.	16 & 27 Feb., '29	589	4 6	5 0	21	23	19	9	21	15	14	17	11	12	14	14	135	53	2	190	63	30 7½	(a) 1,150 lbs. ozs. dr. (b) 150 8 1 ozs. (c) 25·1 (d) £8 4 1¾	—	—	6	June
			,,	590	4 8	6 4	—	20	21	4	—	20	24	21	21	25	24	22	—	106	96	202	32	26 6		—	—	—	Aug.
			,,	591	5 0	6 0	26	26	19	8	12	23	20	23	7	13	10	6	26	160	7	193	75	31 2½		—	—	2	Sept.
			,,	592	4 8	6 0	3	24	14	1	18	18	24	24	25	20	21	18	14	123	73	210	38	28 1½		1	—	1	—
			,,	593	4 8	6 8	—	4	12	17	17	23	24	27	22	21	21	18	49	154	3	206	19	27 1¼		—	—	—	Aug.
			,,	594	4 8	7 0	7	20	4	—	—	—	6	20	22	17	26	26	2	70	76	148	17	26 4		—	—	1	Dec.
				U.T.	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	1	1	0 3					
3	105	*Buff Rock.* Sister-in-Charge, Technical School, Stradbally Laoighis.	21/3/29	625	4 14	5 0	19	25	22	21	23	21	24	20	15	15	20	9	1	137	96	234	44	34 2¾	(a) 1,093 lbs. ozs. dr. (b) 151 3 13 ozs. (c) 26·6 (d) £8 2 7¼	—	—	2	July
			,,	626	6 4	5 12	15	10	5	—	4	19	13	13	—	—	—	—	9	60	10	79	27	12 1		—	—	—	Jan.
			,,	627	5 0	6 0	6	—	4	19	15	20	20	18	11	7	6	—	24	96	6	126	11	15 11¼		—	—	1	July
			,,	628	6 0	5 12	12	24	21	19	19	21	17	22	18	20	19	16	216	12	—	228	62	35 5¼		—	—	—	July
			,,	629	4 12	5 8	15	20	20	20	22	19	19	13	16	13	14	16	129	73	5	207	60	32 4		—	—	2	Aug.
			,,	630	5 0	5 0	11	16	20	21	19	24	20	23	18	17	9	19	184	33	—	217	53	32 3¾		—	—	—	July
				U.T.	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	1	1	2	—	0 3½					

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs).   U.T. = Untrapped.

SECTION VI.—SITTING BREEDS OTHER THAN WHITE WYAND.TTE (STATION HOLDERS).—continued.

Order of Merit.	No. of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
4	107	*Buff Rock.*	February	637	5 0	4 12	7	15	6	3	21	21	24	11	22	15	20	22	113	71	3	187	28	26 1½	(a) 1,108	—	—	2	July
		Mrs. K. McCabe,	,,	638	5 0	6 0	2	19	16	19	20	18	24	12	19	19	15	22	85	119	1	205	43	30 2¼	lbs. ozs. dr.	—	—	2	July
		Derry,	,,	639	4 12	6 8	6	14	12	18	22	21	12	16	4	18	14	17	33	123	18	174	37	25 6¾	(b) 149 12 13	—	—	4	July
		Aughnamullen,	,,	640	4 12	4 4	6	19	15	14	18	21	20	17	5	9	10	9	6	90	67	163	31	23 0	ozs.	—	—	2	July
		Ballybay,	,,	641	4 12	6 0	8	20	18	9	19	22	14	15	12	10	10	13	44	112	14	170	46	25 10½	(c) 26·0	—	—	6	—
		Co. Monaghan.	,,	642	4 12	6 4	9	18	18	17	22	20	11	23	15	25	13	18	117	85	7	209	48	31 3¾	(d) £8 2 0¾	—	—	1	Aug.
5	89	*Rhode I. Red.*	22/2/29	529	4 6	5 0	—	—	10	21	22	23	25	24	17	22	15	17	67	127	2	196	17	25 4	(a) 1,137	—	—	—	Aug.
		MissM. O'Donovan,	,,	530	4 8	6 0	10	17	20	20	23	26	24	24	20	23	6	16	13	127	89	229	38	31 4¼	lbs. ozs. dr.	—	—	2	Aug.
		Dromore,	,,	531	4 12	6 0	12	16	—	—	19	22	17	13	16	—	18	7	43	81	16	140	21	19 8½	(b) 148 3 8	—	—	3	Nov., June
		Villierstown,	,,	532	4 8	5 4	15	21	22	22	17	21	20	22	15	17	19	21	5	213	14	232	56	35 9¾	ozs.	—	—	—	Aug.
		Cappoquin,	,,	533	5 0	7 0	5	11	23	8	10	21	23	17	23	18	21	21	10	180	11	201	39	28 8½	(c) 25·0	—	—	—	Sept.
		Co. Waterford.	,,	534	4 8	5 0	17	11	2	3	16	20	19	19	16	15	—	—	19	90	29	138	27	18 9½	(d) £7 19 9¾	—	—	—	Sept.
				U.T.	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	1	—	0 1¼					
‡*.	101	*Rhode I. Red.*	22/3/29	601	5 0	5 12	21	20	19	15	7	18	22	18	19	16	16	12	17	170	16	203	52	31 3¼	(a) 1,018	—	—	—	Aug.
		Mrs. L. K. Murphy,	,,	602	5 0	6 0	13	18	10	15	14	13	20	18	18	14	14	16	7	47	129	183	16	23 9	lbs. ozs. dr.	3	—	1	—
		Knockreigh,	,,	603	5 0	6 8	20	24	23	22	23	22	27	11	18	8	22	24	136	105	3	244	70	38 4¼	(b) 132 6 4	1	—	2	July
		Adamstown,	,,	604	5 0	6 0	4	19	19	19	16	23	23	18	19	17	9	17	43	154	6	203	45	30 0	ozs.	—	—	—	Sept.
		Co. Wexford.	,,	605	5 0	5 0	15	19	22	9	—	10	14	18	10	15	12	17	3	47	111	161	19	23 2½	(c) 25·0	1	—	4	Feb., June
			,,	606	5 4	—	11	10	2	—	—	—	—	—	—	—	—	—	7	12	4	23	19	5 4¼	(d) £7 12 0½	1	9/1/30	—	—
				U.T.	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	1	—	0 1¼					
6	97	*Rhode I. Red.*	24/3/29	577	4 8	5 8	19	11	—	25	15	20	21	23	17	19	18	12	103	97	—	200	37	28 5½	(a) 1,101	—	—	—	—
		Miss C. Mealiff,	,,	578	5 0	7 0	16	20	—	10	18	14	20	17	13	8	14	12	107	50	5	162	33	24 2¼	lbs. ozs. dr.	—	—	—	—
		Ballinamona Ho.,	,,	579	4 12	5 12	14	9	2	—	19	26	27	24	14	23	9	20	116	71	—	187	25	25 0¼	(b) 152 10 8	—	—	2	July
		Tullamore,	,,	580	4 8	7 0	11	17	16	16	19	20	22	18	12	20	19	14	128	64	12	204	36	30 0¼	ozs.	—	—	—	—
		Offaly	,,	581	5 0	7 4	—	—	5	23	24	25	25	23	12	10	17	11	66	107	2	175	12	22 3¼	(c) 26·6	—	—	4	July
			,,	582	4 12	6 12	2	8	—	—	18	21	23	25	23	8	24	20	63	106	3	172	9	21 9	(d) £7 11 10½	—	—	1	—
				U.T.	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	1	—	0 2					
7	109	*Buff Rock.*	February	649	4 12	5 0	—	—	—	17	23	22	26	22	22	9	23	21	15	159	11	185	—	22 9½	(a) 1,033	—	—	—	Oct., July
		Mrs. L. Mounsey,	,,	650	4 12	5 8	—	—	—	—	15	11	18	16	7	20	8	21	40	75	1	116	—	14 0¾	lbs. ozs. dr.	—	—	1	Oct., Aug.
		Beech Hill,	,,	651	5 0	5 0	9	21	22	22	22	19	17	14	9	9	10	7	80	99	2	181	58	28 10½	(b) 143 3 5	—	—	4	July
		Tullamore,	,,	652	5 8	7 0	8	16	21	24	23	25	27	19	19	21	16	17	187	49	—	236	51	34 5¾	ozs.	—	—	1	July
		Offaly.	,,	653	5 4	5 8	19	22	18	20	20	18	22	11	19	10	4	—	122	61	—	183	66	29 4	(c) 26·6	—	—	2	Aug.
			,,	6 4	5 0	6 0	—	4	11	20	14	17	7	19	13	5	8	13	67	64	—	131	21	18 5½	(d) £7 8 1¼	—	—	2	July
				U.T.	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	1	—	0 1¼					

* Disqualified under Clause 21 (more than 23 per cent. second grade eggs).
‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

U.T. = Untrapped.

SECTION VI.—SITTING BREEDS OTHER THAN WHITE WYANDOTTE. (STATION HOLDERS)—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test. lb. oz.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
‡	100	*Rhode I. Red.*	March	595	5 4	7 0	21	17	17	15	21	21	20	18	11	20	8	14	36	149	18	203	45	30 9	(a) 982	—	—	2	Aug.
		Mrs. A. L. Hurley,	,,	596	5 4	6 0	21	20	17	18	22	22	21	21	15	14	—	6	37	68	92	197	5	27 5	lbs. ozs. dr.	1	—	—	July
		Cloncorban,	,,	597	5 0	6 8	12	22	23	22	22	22	17	11	—	—	12	7	85	80	5	170	58	28 1	(b) 131 0 11	—	—	1	June, Sept.
		Ballineen,	,,	598	5 0	5 12	6	10	—	13	8	20	23	23	21	15	22	22	160	22	1	183	21	24 9¼	ozs.	—	—	—	June
		Co. Cork.	,,	599	5 4	5 4	1	21	20	12	11	20	23	11	6	5	—	—	2	78	50	130	11	18 7	(c) 25·6	1	—	3	June, Sept.
			,,	600	5 0	6 4	21	18	4	4	6	—	15	11	11	—	7	—	—	79	18	97	35	16 3½	(d) £7 6 1¼	—	—	—	July
				U.T.	—	—	—	—	—	—	—	—	—	—	2	—	—	—	2	—	—	2	—	0 2½					
‡	110	*Buff Rock.*	8/3/29	655	6 0	6 4	9	6	—	8	21	22	23	14	16	15	14	3	29	119	3	151	14	19 6¾	(a) 989	—	—	4	June, Sept.
		Mrs. M. Ffrench,	,,	656	4 12	5 0	18	16	10	—	—	14	16	15	17	12	16	23	48	103	6	157	40	24 0¼	lbs. ozs. dr.	—	—	4	Jan., Sept.
		Poulfaille Cottage,	,,	657	5 0	6 0	7	13	10	15	18	18	19	14	15	10	9	8	152	2	2	156	33	22 10	(b) 138 3 0	—	—	—	July
		New Ross,	,,	658	5 0	5 8	—	12	3	—	19	22	23	20	12	14	1	18	94	50	—	144	15	18 7½	ozs.	—	—	4	Oct., June
		Co. Wexford.	,,	659	5 8	6 0	22	20	18	19	21	22	22	19	17	9	14	17	16	181	23	220	49	33 4¼	(c) 26·8	—	—	2	July
			,,	660	5 4	6 0	21	18	—	—	13	23	21	15	12	12	12	14	94	67	—	161	39	23 9¼	(d) £7 2 2	—	—	5	Dec., June
8	95	*Rhode I. Red.*	February	565	4 8	5 8	1	21	14	18	16	20	11	10	10	7	4	5	—	101	36	137	33	20 3½	(a) 1,035	—	—	—	—
		Mrs. B. Healy,	,,	566	4 4	5 0	—	16	22	16	19	23	21	20	18	14	21	21	85	125	1	211	39	30 8¼	lbs. ozs. dr.	—	—	—	—
		Kildologue,	,,	567	4 8	6 4	1	22	17	23	19	22	24	22	20	16	6	15	4	187	16	207	42	29 11¼	(b) 136 14 6	1	—	—	Aug.
		Strokestown,	,,	568	4 8	6 12	—	—	—	20	22	25	25	26	21	15	16	10	5	133	42	180	3	20 9½	ozs.	—	—	—	—
		Co. Roscommon.	,,	569	4 4	6 4	—	—	—	10	22	23	20	19	17	13	2	—	88	35	3	126	—	14 5½	(c) 25·4	—	—	—	Aug.
			,,	570	4 4	5 0	6	10	21	20	17	23	23	19	7	11	12	—	47	119	3	169	43	24 8½	(d) £7 1 10¾	—	—	—	Aug.
				U.T.	—	—	—	—	4	—	—	—	—	—	—	—	1	—	—	4	1	5	3	1 0¼					
9	98	*Rhode I. Red.*	15/3/29	583	4 10	6 0	5	2	19	17	20	21	21	15	10	16	10	5	23	120	18	161	29	21 9¾	(a) 1,044	—	—	2	Aug.
		Mrs. B. Martin,	,,	584	4 7	5 8	—	14	15	18	12	24	18	16	13	10	9	8	3	108	46	157	27	21 7½	lbs. ozs. dr.	—	—	4	July
		Croughatens,	,,	585	4 6	6 0	—	—	6	5	14	21	22	18	15	15	23	10	47	92	10	149	6	18 4¼	(b) 143 6 0	—	—	4	Sept.
		Ballylooby,	,,	586	4 8	5 12	—	13	21	20	22	21	24	15	15	15	16	17	39	135	25	199	40	28 4½	ozs.	—	—	4	—
		Cahir,	,,	587	4 6	5 4	—	13	11	18	17	23	23	25	23	22	9	11	178	16	1	195	30	26 7½	(c) 26·4	—	—	—	Aug.
		Co. Tipperary.	,,	588	4 12	7 8	—	—	14	24	22	27	16	20	16	16	14	13	168	14	—	182	22	24 2¼	(d) £7 1 2	—	—	4	Sept.
				U.T.	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	—	1	—	0 2¼					
†‡*	90	*Rhode I. Red.*	3/3/29	535	4 8	5 8	12	22	17	22	25	21	22	17	14	7	18	19	1	109	106	216	41	30 7¼	(a) 981	1	—	5	July
		Miss G. Bradshaw,	,,	536	4 8	5 4	12	25	20	12	19	22	20	23	19	20	21	22	2	121	112	235	56	32 10¼	lbs. ozs. dr.	2	—	1	June
		Redhill Farm,	,,	537	5 4	6 0	22	9	8	—	12	17	18	15	10	12	15	14	15	113	24	152	36	21 10½	(b) 122 3 1	—	—	5	Dec., Aug.
		Mohill,	,,	538	4 8	5 8	10	14	5	—	8	22	24	15	13	11	16	—	11	111	16	138	27	19 1	ozs.	1	—	4	Jan., Aug.
		Co. Leitrim.	,,	539	4 6	5 0	12	19	11	16	20	15	18	11	11	6	9	10	2	26	130	158	7	20 11½	(c) 23·9	9	—	5	July
			,,	540	4 7	—	6	21	10	17	19	9	—	—	—	—	—	—	41	39	2	82	39	15 5½	(d) £7 0 10	—	18/3/30	—	—

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.
† Disqualified under Clause 19 (eggs failed to reach standard weight of 24 ozs. per dozen.
‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

SECTION VI.—SITTING BREEDS OTHER THAN WHITE WYANDOTTE. (STATION HOLDERS)—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test. lb. oz.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
†‡*	102	*Rhode I. Red.*	March	607	4 4	4 8	—	13	9	—	14	22	25	25	23	7	20	19	—	18	159	177	5	19 2½	(a) 1,016	—	—	1	Aug.
		Mrs. A. Naughton,	,,	608	4 8	4 12	16	22	21	24	22	21	13	13	16	10	14	13	2	56	147	205	14	28 7½	lbs. ozs. dr.	—	—	4	Aug.
		Larkfield House,	,,	609	4 8	6 8	8	17	20	21	19	20	19	23	18	10	—	4	43	127	9	179	48	26 9	(b) 125 4 0	—	—	—	—
		Athlone,	,,	610	4 6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	ozs.	—	14/4/30	—	—
		Co. Roscommon.	,,	611	4 8	—	24	24	20	20	22	22	23	22	24	20	3	1	—	48	177	225	12	29 11	(c) 23·7	—	30/8/30	—	—
			,,	612	4 6	4 12	15	21	22	21	20	23	23	25	23	16	15	5	17	173	39	229	61	33 10	(d) £6 18 5¼	—	—	—	—
				U.T.			—	—	—	—	—	—	1	—	—	—	—	—	—	1	—	1	—	0 1¼					
10	88	*Rhode I. Red.*	9/4/29	523	5 0	5 12	15	21	15	9	19	27	26	25	25	11	22	19	38	183	13	234	43	33 11½	(a) 1,033	—	—	1	July
		Mrs. E. Sheehy,	,,	524	5 0	6 4	—	—	5	—	15	22	19	14	21	19	19	17	65	80	6	151	1	18 7½	lbs. ozs. dr.	—	—	—	Sept.
		Bridge House,	,,	525	4 10	5 4	—	2	11	2	20	23	21	25	2	18	20	16	22	131	7	160	9	20 5¼	(b) 136 8 9	1	—	—	—
		Ballingarry,	,,	526	4 8	5 4	12	21	13	—	14	24	21	21	20	22	22	16	17	178	11	206	41	29 11¾	ozs.	—	—	1	Dec.
		Co. Limerick.	,,	527	4 10	6 0	—	—	3	3	16	16	21	14	19	12	4	9	21	88	8	117	3	14 0¾	(c) 25·4	—	—	1	Sept.
			,,	528	5 0	6 8	—	—	8	6	—	14	27	25	24	22	14	23	8	121	34	163	2	19 2	(d) £6 16 6	—	—	—	Jan., July
				U.T.			—	—	—	—	—	—	—	—	1	—	—	1	—	2	—	2	—	0 3¼					
‡	106	*Buff Rock.*	7/3/29	631	5 8	—	1	8	—	—	—	—	—	—	—	—	—	—	1	8	—	9	9	2 3¾	(a) 893	—	20/1/30	—	—
		Mrs. V. McCann,	,,	632	5 12	5 12	14	24	18	17	13	21	25	16	9	19	—	22	61	127	10	198	50	30 9½	lbs. ozs. dr.	—	—	2	July
		Ballymun House,	,,	633	5 4	6 4	19	22	23	24	22	16	17	12	16	13	3	—	142	44	1	187	70	30 5½	(b) 122 3 4	—	—	1	July
		Santry,	,,	634	6 4	7 0	20	24	—	—	10	20	23	20	13	12	16	20	20	129	29	178	33	25 3¾	ozs.	—	—	3	Dec., Aug.
		Co. Dublin.	,,	635	5 4	6 0	—	12	19	21	20	22	23	23	19	17	14	18	100	195	3	208	34	29 5	(c) 26·3	—	—	—	Aug.
			,,	636	5 12	6 4	9	—	—	—	7	15	17	8	6	20	7	17	67	38	1	106	9	13 11	(d) £6 12 10	1	—	2	Aug.
				U.T.			—	—	3	4	—	—	—	—	—	—	—	—	6	1	—	7	6	0 7½					
†‡*	103	*Light Sussex.*	9/3/29	613	5 8	6 0	18	24	22	18	21	18	12	12	12	13	13	19	5	135	62	202	59	31 3	(a) 984	—	—	4	Aug.
		Miss E. Walsh,	,,	614	5 4	5 4	10	24	5	19	22	21	16	17	11	26	8	12	—	99	92	191	39	26 9½	lbs. ozs. dr.	—	—	4	—
		Ballylemon Lodge,	,,	615	5 4	6 8	—	—	4	21	22	20	22	10	13	22	8	13	1	86	68	155	3	18 1¼	(b) 119 12 9	—	—	3	—
		Cappagh,	,,	616	5 8	—	16	21	5	2	18	12	17	12	9	10	9	—	1	51	79	131	23	18 6¾	ozs.	—	23/8/30	7	—
		Co. Waterford.	,,	617	5 12	5 12	21	19	3	10	21	12	10	16	11	13	12	15	—	61	102	163	13	22 1¼	(c) 23·4	—	—	6	—
			,,	618	5 8	6 0	2	—	1	11	18	15	18	15	12	14	15	15	—	27	109	136	1	14 3¼	(d) £6 11 9½	9	—	6	—
				U.T.			—	4	1	1	—	—	—	—	—	—	—	—	—	5	1	6	5	0 8½					
‡	114	*Barred Rock.*	22/3/29	679	5 12	6 8	8	10	10	19	20	26	19	23	22	19	11	12	171	28	—	199	34	27 2¾	(a) 870	—	—	—	Sept.
		Mrs. M. O'Neill,	,,	680	5 8	6 8	—	—	7	23	22	24	26	27	21	11	22	10	65	121	7	193	13	24 4½	lbs. ozs. dr.	—	—	1	Oct., Aug.
		Shanoo,	,,	681	5 8	6 4	20	9	17	20	20	25	25	27	21	20	17	16	3	176	58	237	30	31 11¼	(b) 117 5 13	—	—	—	Aug.
		Bridgetown,	,,	682	6 0	—	13	10	2	4	8	—	5	5	2	—	—	—	11	34	4	49	21	8 11¾	ozs.	—	.0/6/ 0	—	—
		Co. Wexford.	,,	683	6 0	8 0	—	9	23	17	25	23	18	15	18	9	3	6	52	109	5	166	35	23 7¼	(c) 25·9	—	—	—	Jan., Sept
			,,	684	5 8	—	16	10	—	—	—	—	—	—	—	—	—	—	2	23	1	26	26	6 4¾	(d) £6 2 6¼	—	30/11/29	—	—

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T.=Untrapped.
† Disqualified under Clause 19 (eggs failed to reach standard weight. of 24 ozs. per dozen).
‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

SECTION VI.—SITTING BREEDS OTHER THAN WHITE WYANDOTTE. (STATION HOLDERS)—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Pullet.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June 22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Pullet. Special Grade.	First Grade.	Second Grade.	Total.	First Grade—16 Oct.-15 Jan.	Value per Pullet. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
‡	44	*Rhode I. Red.*	March	259	4 8	6 0	—	—	6	21	20	20	24	23	22	19	20	15	106	81	3	190	12	24 2¾	(a) 842	—	—	—	July
		Mrs. M. Burton,	,,	260	4 14	5 0	13	20	11	—	2	20	21	25	23	24	21	23	7	165	31	203	43	29 3	lbs. ozs. dr.	—	—	—	Jan.
		Mine Hill,	,,	261	5 0	5 4	—	14	16	1	14	21	20	21	15	15	15	9	14	144	3	161	30	22 6	(b) 112 0 11	—	—	—	July
		Millstreet,	,,	262	5 0	4 12	—	—	11	21	14	13	26	18	14	17	12	5	6	113	32	151	12	18 11¼	ozs.	1	—	2	Oct., Sept.
		Co. Cork.	,,	263	4 8	5 8	—	—	—	—	17	19	23	14	16	13	21	14	80	53	4	137	—	16 3½	(c) 25·5	—	—	4	Sept.
			,,	264	4 8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		(d) £5 11 2½	—	19-11-29	—	—
†‡*	113	*Barred Rock.*	4/4/29	673	4 12	6 0	4	13	—	9	23	25	24	15	18	19	14	25	3	91	95	189	2	22 8½	(a) 872	12	—	4	Oct., Aug.
		Miss B. Power,	,,	674	4 12	6 12	—	—	10	10	9	27	23	17	14	16	20	9	36	91	28	155	7	18 10¾	lbs. ozs. dr.	1	—	4	Aug.
		Slieverue,	,,	675	5 8	—	13	4	—	—	—	—	—	—	—	—	—	—	—	1	16	17	1	3 5¾	(b) 108 11 1	—	11/2/30	—	—
		Butlerstown,	,,	676	5 8	7 0	4	—	—	2	22	23	25	14	20	11	19	21	—	55	106	161	—	16 9	ozs.	—	—	1	Oct.
		Co. Waterford.	,,	677	4 12	5 12	2	10	6	5	14	13	23	14	17	17	14	14	—	41	108	149	1	17 3½	(c) 23·9	15	—	—	Aug.
			,,	678	4 12	6 4	6	19	5	19	20	25	25	24	23	20	13	—	32	108	59	199	7	25 9¾	(d) £5 5 2¾	2	—	—	Oct.
				U.T.	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	1	—	2	—	0 3½					
‡	104	*Light Sussex.*	2/3/29	619	5 8	5 12	3	—	—	2	23	24	26	13	18	21	9	22	29	115	17	161	2	18 9½	(a) 681	—	—	3	Oct.
		Mrs. K. O'Brien,	2/2/29	620	6 0	6 0	4	—	—	—	12	22	14	11	17	9	3	16	64	42	2	108	4	12 7½	lbs. ozs. dr.	—	—	2	June
		Ballykilmurry,	,,	621	5 8	5 8	2	20	12	—	—	—	18	13	8	—	—	—	34	36	3	73	32	12 4½	(b) 92 14 6	—	—	3	July
		Tullamore,	,,	622	6 0	5 12	—	17	16	—	2	22	18	14	14	11	11	7	118	13	1	132	33	19 5¼	ozs.	—	—	5	Sept.
		Offaly.	,,	623	5 4	—	6	—	—	—	—	—	—	—	—	—	—	—	—	2	4	6	2	0 11	(c) 26·2	—	8/1/30	—	—
			,,	624	5 8	6 8	—	1	21	21	20	22	21	23	21	15	19	17	29	160	12	201	26	27 1	(d) £4 11 2¾	—	—	—	Oct., Aug.
‡	57	*Rhode I. Red.*	March	337	4 7	5 0	17	15	—	3	16	22	25	26	25	24	21	21	80	130	5	215	29	29 7¼	(a) 626	—	—	—	Dec.
		Miss A. Scanlan,	,,	338	4 8	5 8	—	—	—	4	24	24	24	20	14	13	11	12	2	105	39	146	—	16 3	lbs. ozs. dr.	—	—	4	—
		Ballyduhig House,	,,	339	4 8	—	5	16	—	—	—	—	—	—	—	—	—	—	3	18	—	21	21	5 3½	(b) 83 11 2	—	7/12/29	—	—
		Ballagh,	,,	340	4 12	—	9	12	—	—	—	—	—	—	—	—	—	—	—	20	1	21	20	5 2½	ozs.	—	3/12/29	—	—
		Charleville,	,,	341	4 10	5 12	11	14	—	14	24	25	23	24	23	22	22	19	112	104	5	221	23	30 2¾	(c) 25·7	1	—	—	—
		Co. Limerick	,,	342	4 8	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	0 2¾	(d) £4 6 11½	1	6/12/29	—	—
				U.T.	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	1	—	0 1¾					

* Disqualified under Clause 21 (more than 20 per cent. second grade eggs). U.T. = Untrapped.
† Disqualified under Clause 19 (eggs failed to reach standard weight of 24 ozs. per dozen).
‡ Disqualified under Clause 21 (pen produced less than 1,020 eggs).

DUCK SECTION.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Duck.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Duck. First Grade.	Second Grade.	Total.	Value per Duck.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
1	120	*Indian Runner.* Miss D. Strong, Moate House, Kells, Co. Meath.	23/4/29 16/4/29 23/4/29 ,,	705 706 707 708	4 4 4 0 4 0 4 0	4 0 4 4 3 4 4 0	28 14 26 28	28 23 24 27	24 21 8 27	25 — — 20	20 12 16 22	24 26 20 19	28 25 22 10	27 26 26 13	20 23 23 25	18 24 15 22	20 17 9 24	21 — — 17	281 210 187 249	2 1 2 5	283 211 189 254	s. d. 39 3¾ 27 10½ 26 1 35 10	(a) 937 lbs. ozs. dr. (b) 164 5 5 ozs. (c) 33·7 (d) £6 9 1¼	— 1 — —	— — — —	— — — —	July Jan., Aug. — Feb.
	115	*Indian Runner.* Mrs. K. Sheehy, Bridge House, Ballingarry, Co. Limerick.	Apr.-May ,, ,, ,,	685 686 687 688	4 4 4 0 4 0 3 12	4 4 — 3 12 4 4	26 27 26 25	25 25 28 3	22 20 14 —	16 14 19 —	17 — 14 14	19 11 18 22	22 10 22 2[illegible]	24 25 20 27	26 28 19 25	17 21 23 21	— — 20 1[illegible]	14 — 1 7	209 97 102 122	19 84 122 [illegible]7	228 181 224 79	31 10 25 3¾ 29 3 20 8	(a) 812 lbs. ozs. dr. (b) 127 7 7 ozs. (c) 30·1 (d) £5 7 0¾	— 16 17 4	— 5/8/30 — —	— — — —	July Jan. July Aug.
*	124	*Khaki Campbell.* Mrs. R. B. Eadie, The Poplars, Beaufort, Co. Kerry.	17/5/29 ,, ,, ,,	721 722 723 724	4 4 4 0 4 4 4 8	4 8 3 12 4 4 4 4	5 — 13 5	25 18 24 26	25 9 23 25	22 13 14 23	24 16 19 24	26 17 19 25	27 27 17 28	28 26 24 26	22 26 20 23	23 20 17 20	7 — 3 5	— — 3 —	176 16 170 209	58 156 26 21	234 172 196 230	s. d. 29 11¼ 18 4½ 26 11¾ 30 5¾	(a) 832 lbs. ozs. dr. (b) 131 6 4 ozs. (c) 30·3 (d) £5 5 9	— — — —	— — — —	— — — —	July July Feb., July Aug.
*	117	*Indian Runner.* Miss E. Lynch, Lisnabrinnia Ho., Mountnugent, Co. Cavan.	March ,, ,, ,,	693 694 695 696	3 8 4 4 3 8 3 8	4 0 3 8 3 8 3 4	11 27 15 —	1 27 18 —	9 27 22 13	8 19 5 3	7 22 5 9	14 23 8 11	15 21 10 24	19 17 11 14	16 24 22 20	15 21 18 16	14 23 3 7	9 16 21 8	133 260 97 87	5 7 61 38	138 267 158 125	16 8¾ 37 2¾ 20 9 13 6¼	(a) 688 lbs. ozs. dr. (b) 113 9 11 ozs. (c) 31·7 (d) £4 8 2¾	— — 22 2	— — — —	— — — —	Dec., Aug. Jan. Jan., July Feb., Aug.
‡*	126	*Khaki Campbell.* Miss M. Cremin, Granavorig, Newmarket, Co. Cork.	22/4/29 ,, ,, ,,	729 730 731 732	4 6 4 0 4 12 4 0	4 8 4 4 4 4 3 12	23 22 — —	26 26 8 3	23 17 25 2	23 — 17 10	20 1 — 12	9 6 18 6	12 22 27 13	23 23 23 1	23 18 15 17	21 23 — 4	— 3 — —	— — 21 13	184 70 122 24	19 91 32 57	203 161 154 81	29 6¾ 21 8½ 19 2¼ 8 7¾	(a) 599 lbs. ozs. dr. (b) 93 9 11 ozs. (c) 30·0 (d) £3 19 1¼	— 14 1 74	— — — —	— — — —	July Jan., July Feb., June July

* Disqualified under Clause 13 (more than 15 per cent. second grade eggs).
‡ Disqualified under Clause 13 (pen produced less than 680 eggs).

DUCK SECTION—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Duck.	Weight. On Arrival. lb. ozs.	Weight. At Close of Test lb. ozs.	Eggs Laid 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 Apl.-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Duck. First Grade.	Second Grade.	Total.	Value per Duck. s. d.	(a) Total Eggs from Pen (b) Total Weight (c) Weight per Dozen (d) Total Value from Pen.	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
‡*	121	*Indian Runner.*	March	709	3 8	4 4	—	18	15	17	26	22	24	24	24	18	—	4	185	7	192	24 3	(a) 675	—	—	—	July
		Mrs. B. Healy, Kildologue,	,,	710	3 4	4 8	—	—	6	8	13	19	22	24	23	20	14	—	114	35	149	15 8½	lbs. ozs. dr. (b) 109 5 14	1	—	—	Feb., July
		Strokestown,	,,	711	3 8	4 0	8	18	21	18	20	18	23	23	16	16	11	—	141	51	192	24 8½	ozs. (c) 31·1	—	—	—	July
		Co. Roscommon.	,,	712	3 8	4 0	—	—	—	4	24	19	18	22	25	12	18	—	99	43	142	14 4½	(d) £3 19 0¼	—	—	—	July
‡*	128	*Khaki Campbell.* Miss P. Healy,	10/3/29	737	4 8	4 0	15	6	11	9	5	3	6	7	7	5	1	13	51	37	88	12 3½	(a) 557	12	—	—	Jan., June
		Clonmeen,	,,	738	4 12	4 8	22	26	27	18	—	11	25	26	27	18	—	—	180	20	200	28 10¾	lbs. ozs. dr. (b) 85 5 0	2	—	—	Feb., July
		Banteer,	,,	739	4 4	4 0	7	17	9	—	—	3	3	12	18	18	—	—	27	60	87	11 4½	ozs. (c) 29·4	49	—	—	Dec., July
		Co. Cork.	,,	740	4 0	3 8	23	28	18	14	—	6	10	19	25	23	1	15	62	120	182	24 8½	(d) £3 17 3¼	29	—	—	Dec., July
*	130	*Khaki Campbell.* Miss K. Morrissey,	24/4/29	745	4 0	3 12	4	24	24	24	24	22	21	21	21	20	21	21	136	111	247	30 2	(a) 681	14	—	—	—
		Jamestown,	,,	746	4 0	3 12	—	19	2	6	12	3	7	26	20	16	—	—	36	75	111	12 11	lbs. ozs. dr. (b) 102 12 1	61	—	—	July
		Piltown,	,,	747	3 12	3 12	—	11	21	22	18	23	24	27	21	23	1	—	57	134	191	21 4	ozs. (c) 29·0	7	—	—	Feb., July
		Co. Kilkenny.	,,	748	3 12	4 0	—	—	4	14	25	20	8	19	23	19	—	—	28	104	132	12 9¾	(d) £3 17 2¾	56	—	—	June
‡*	119	*Indian Runner.* Mrs. A. McGrath,	May	701	3 4	3 12	—	—	11	12	15	13	19	19	26	13	1	12	86	55	141	15 1	(a) 653	6	—	—	July
		Bamford,	,,	702	4 0	3 8	—	5	15	22	25	9	17	25	25	25	8	16	96	96	192	21 3½	lbs. ozs. dr. (b) 97 8 10	23	—	—	July
		Co. Kilkenny.	,,	703	3 8	3 12	21	27	8	14	19	11	16	18	14	21	—	21	25	165	190	23 10¼	ozs. (c) 28·7	62	—	—	Jan., July
			,,	704	3 8	3 8	3	22	3	18	13	5	10	15	16	11	—	14	11	119	130	15 8¼	(d) £3 15 11	95	—	—	Feb., July
‡*	129	*Khaki Campbell.* Mrs. M. Nagle,	15/5/29	741	—	3 12	14	9	1	14	20	23	27	24	21	17	—	13	77	106	183	20 11	(a) 575	17	—	—	July
		Springmount,	,,	742	—	3 12	8	26	2	15	17	4	7	8	4	13	8	—	20	92	112	15 2	lbs. ozs. dr. (b) 84 3 3	120	—	—	Aug.
		Mallow,	,,	743	—	3 4	18	27	20	22	26	22	26	11	19	15	—	17	33	190	223	27 9	ozs. (c) 28·1	40	—	—	July
		Co. Cork.	,,	744	—	3 8	—	—	1	—	7	3	1	1	7	19	—	18	7	50	57	5 3½	(d) £3 9 1½	81	—	—	July

* Disqualified under Clause 13 (more than 15 per cent. second grade eggs).

‡ Disqualified under Clause 13 (pen produced less than 680 eggs).

DUCK SECTION—continued.

Order of Merit.	Number of Pen.	Name and Address of Owner.	Date of Hatching.	No. of Duck.	Weight. On Arrival. lb. oz.	Weight. At Close of Test lb. oz.	Eggs Laid. 16 Oct.-12 Nov.	13 Nov.-10 Dec.	11 Dec.-7 Jan.	8 Jan.-4 Feb.	5 Feb.-4 Mar.	5 Mar.-1 Apl.	2 Apl.-29 Apl.	30 April-27 May	28 May-24 June	25 June-22 July	23 July-19 Aug.	20 Aug.-16 Sept.	Eggs per Duck. First Grade.	Second Grade.	Total.	Value per Duck. s. d.	(a) Total Eggs from Pen (b) Total Weight. (c) Weight per Dozen (d) Total Value from Pen	Eggs under Prescribed Weight.	Date of Death.	Number of Times Broody.	Date of Moulting.
‡*	1 7	*Khaki Campbell.* Mrs. K. Healy, Clonmeen, Banteer, Co. Cork.	10/3/29	733	4 0	4 0	14	27	11	1	—	5	7	23	23	25	3	11	23	127	150	18 9¾	(a) 570 lbs. ozs. dr. (b) 85 7 11 ozs. (c) 28·8 (d) £3 7 9¼	53	—	—	Dec., July
			,,	734	4 4	4 0	17	12	13	1	2	8	13	15	18	17	13	—	41	88	129	15 10¼		35	—	—	Jan., July
			,,	735	4 8	3 12	—	5	1	5	15	13	17	23	21	16	—	23	28	111	139	13 5¾		35	—	—	Feb., July
			,,	736	4 0	4 0	17	20	11	—	3	16	20	19	19	14	—	13	125	27	152	19 7½		5	—	—	Dec., July
‡*	125	*Khaki Campbell.* Mrs. C. O'Shea, Codrum, Macroom, Co. Cork.	31/5/29	725	4 0	3 12	—	—	2	13	17	22	19	19	15	17	—	11	87	48	135	14 2¼	(a) 594 lbs. ozs. dr. (b) 91 12 9 ozs. (c) 29·7 (d) £3 5 6½	30	—	—	July
			,,	726	4 0	3 8	—	24	22	9	20	18	16	21	19	16	—	14	78	101	179	21 10		24	—	—	July
			,,	727	4 8	4 0	—	—	6	11	3	6	8	10	14	21	6	—	22	63	85	8 6¼		45	—	—	Aug.
			,,	728	4 0	4 4	2	2	12	17	22	23	27	24	20	22	22	2	115	80	195	20 11½		12	—	—	Aug.
‡	116	*Indian Runner.* Mrs. R. Shiel-Walshe, Moneyvroe, Cappoquin, Co. Waterford.	March	689	3 12	3 12	—	—	—	3	16	20	16	17	10	5	—	8	78	17	95	9 10½	(a) 523 lbs. ozs. dr. (b) 85 12 11 ozs. (c) 31·5 (d) £3 4 2¾	2	—	—	Dec., July
			,,	690	4 0	4 4	23	22	22	16	1	11	20	22	15	18	—	9	170	9	179	26 2¾		—	—	—	Feb., July
			,,	691	3 8	3 4	—	—	1	—	19	22	22	18	4	—	—	—	78	8	86	9 0		—	—	—	June
			,,	692	3 12	3 8	—	—	21	23	21	24	24	15	26	9	—	—	129	34	163	19 1½		—	—	—	June
‡*	122	*Indian Runner.* Mrs. R. Verling, Kill St. Anne, Castlelyons, Fermoy, Co. Cork.	1/5/29	713	3 8	3 12	—	—	—	7	17	18	21	27	25	22	2	—	62	77	139	13 5	(a) 509 lbs. ozs. dr. (b) 75 1 12 ozs. (c) 28·3 (d) £3 2 0½	33	—	—	July
			,,	714	3 8	4 0	21	28	21	1	—	12	20	26	28	19	—	23	63	136	199	25 6		27	—	—	Feb., July
			,,	715	3 8	—	8	20	—	—	—	—	—	—	—	—	—	—	21	7	28	6 1½		2	8/12/29	—	—
			,,	716	3 4	3 8	2	25	9	8	19	16	7	14	19	13	—	11	18	125	143	17 0		83	—	—	Aug.
‡*	118	*Indian Runner.* Miss K. McGrath, Bamford, Co. Kilkenny.	May	697	3 12	4 12	—	6	23	23	21	22	22	25	24	24	—	15	133	72	205	23 9¾	(a) 492 lbs. ozs. dr. (b) 74 2 7 ozs. (c) 28·9 (d) £3 1 1¾	9	—	—	July
			,,	698	3 6	—	12	13	1	3	—	4	5	1	—	—	—	—	3	36	39	6 6½		81	27/5/30	—	Feb.
			,,	699	3 0	3 4	—	—	6	10	14	7	13	13	19	14	1	—	41	56	97	10 0½		16	—	—	July
			,,	700	3 8	4 10	23	25	10	16	20	21	16	14	6	—	—	—	32	119	151	20 9		16	—	—	Aug.

* Disqualified under Clause 13 (more than 15 per cent. second grade eggs).

‡ Disqualified under Clause 13 (pen produced less than 680 eggs).

NOTES AND MEMORANDA.

AGRICULTURAL CO-OPERATION IN SWITZERLAND.

A report of an agricultural survey of Switzerland, made for the United States Bureau of Agricultural Economics, states that out of a total population of about 4,000,000 people in Switzerland, about one-fourth depend upon agriculture for a livelihood. Production and co-operative marketing are more highly developed in Switzerland than in any other country in Europe except, perhaps, Denmark. In 1920 there were 10,942 local co-operative societies with 657,082 members, or an average of nine co-operative memberships for every farm in the country. A single individual may be enrolled in more than one local co-operative society, a local society may be affiliated to more than one central organisation, and more than one member of a farm household may be a member of one or more co-operative societies.

Co-operation and dairying are almost synonymous terms in Switzerland. In 1920 there were 3,519 local co-operative creameries with 102,659 members. They are united into a number of different types of federations, the Central Union of Swiss Milk Producers being the hub of the organised dairy movement. This Union has 35 member federations representing 3,392 local societies, with 99,059 members It controls the product of 534,852 cows out of the 810,000 which compose the country's total herd. It follows therefore that the production of 66 per cent. of all the cows in Switzerland is controlled by one central federation.

Switzerland produces about three-fourths of its food supply, but only one-sixth of its wheat requirement. The value of agricultural imports is about four times that of exports. Two-thirds of the farm receipts of the country come from dairying, cattle-feeding and pig-rearing. Animal products of high quality are exported.

SUGAR BEET INSTITUTE FOR HOLLAND.

Dutch sugar manufacturers have established a central Institute with the object of promoting the beet sugar industry. It will be administered by a Committee consisting of a President, who is an Agricultural Inspector in the Ministry of Agriculture; a Vice-President, who represents the Central Sugar Co., Bloemendaal, and a Secretary, who represents the co-operative sugar factories. The Committee also includes a representative of engineering interests, and Dr. G. Broekema, of the Agricultural College, Wageningen.

The Institute have purchased the laboratory of the old Zealand sugar factory, the equipment of which will be improved for the purpose of carrying out researches in connexion with beet-growing and the production of sugar. The Institute will further take up the work begun six years ago by the Experimental Plots Committee of the sugar industry, and will get into touch with existing institutions, both practical and scientific, with a

view to forming a central organisation in which everything relating to beet-growing will be tried out.

The programme for 1930 included variety tests of beets with calcarious manures, and investigations into the disinfection of beet seed and the time of lifting the beets. A number of other investigations relating to improvements in beet-growing will also be made by the Institute, which will work without any financial assistance from the Government.

GERMAN POTATO-DRYING INDUSTRY.

The nature of the assistance promised by the German Government to the potato-drying industry has now been revealed. In order to relieve the factories of their stocks of manufactured flakes, which are unusually heavy and practically unsaleable under prevailing market conditions, and to enable them to start the new campaign with room for taking in more raw material, the Food Ministry have made an offer for their entire stocks of dried flakes. In taking this step, the Government are also mindful of their scheme for encouraging the use of home-grown rye as a feeding stuff, and are anxious that it should not be hampered by possible forced sales of potato flakes. The price offered for the latter is 1s. 8d. per 50 kg. (110 lb.), which is equivalent to a price of 1s. 3d. per 50 kg. of raw potatoes. The price includes storage fees to 1st October, 1930, also cost of handling in store and fire insurance. The Government's offer does not amount to much more than half the price quoted for potato flakes on the Berlin market in the month of April. The quotation at that time was from 15s. to 16s. In June, the price fell to 12s. or 13s.

In making their offer, the Government disclaim any intention of setting up a State monopoly in regard to future sales of the stocks of potato flakes purchased; their aim is solely to facilitate the marketing of the new potato crop.

THE PEAT INDUSTRY IN HOLLAND.

In the course of an interesting report on the peat industry in the Netherlands, the Canadian Trade Commissioner states that the importance of that industry may be judged by the fact that it provides a livelihood for some 10,000 families. The digging season lasts from March to August, and the product is utilized chiefly as fuel, though peat litter for stable and poultry houses and peat moss for use as packing material are important by-products. The peat fuel is nearly all consumed in Holland, but about 90 per cent. of the by-products is exported, not only to various parts of Europe, but also to South Africa, Canada and the United States. The work of raising the peat has hitherto been done entirely by hand, but the industry is now tending to become at least partly mechanized. The drying of the peat is left to the wind and sun. Various methods of heating and pressing have been tried, but have not been very successful, owing to the colloidal nature of the material. The sods of turf are piled in orderly stacks,

and these are left standing for two years before the peat is considered to be fit for use. The handling of the peat during the drying period is done almost entirely by women.

The Netherlands Government maintains an experimental station at Emmen, which gives scientific advice and assistance in connection with the peat industry. There is one central selling organisation in Rotterdam, through which the marketing of the peat litter and moss is effected. The exports of these two products in 1927 totalled over 64,000 tons, valued at over £67,000.

FRENCH WHEAT RESERVE.

Under the terms of the Law of 1st May, 1930, the French Minister for Agriculture is authorised, within the limits of a credit amounting to 30 million francs, to expend such sums as may be necessary to maintain an emergency reserve of wheat and flour sufficient to feed the French people in case of need. He will, in consultation with the Minister for War, decide upon the localities where this reserve will be stored. The responsibility for the carrying into effect of the scheme in accordance with the conditions laid down in the Law, will rest with the Ministers of Commerce, Finance, and War.

The sum of 100 million francs, provided under the Law of 1st April, 1930, for defraying the cost of refunding customs duties on exported wheat and flour, as regulated by the Law of 1st December, 1929, and the Decree of 4th December, 1929, was subsequently increased to 200 millions.

SWEDISH BUTTER TESTS, 1927 AND 1928.

The number of Swedish creameries which participated in the official butter tests in 1927 was 567, as compared with 514 in the previous year. The increase was due to the general desire of creameries to qualify for the right to use the Rune Brand and to export their butter. The number of tests made per creamery averaged 3.6, and the number of kegs of butter tested was 2,024. The proportion of creameries which actually qualified to use the Rune Brand was 79.3 per cent. As regards moisture content of the butter, the highest reached was 15.9 per cent. and only 3.2 per cent. of all creameries were placed in the highest moisture class 15.1 to 16 per cent. 4.9 per cent. of the creameries were placed in the 12.1 to 13 per cent. class. In 39 creameries, or 7.9 per cent. of all, pasteurization was found to be unsatisfactory. About 35,000 tons of butter, or 3,900 tons more than in the previous year, was found fit to bear the Rune Brand.

In 1928, the number of participating creameries was 559, of which 410 were run on co-operative lines. The average number of tests made per creamery was 3.5, and the number of kegs examined 1954. Of the total number of creameries, 83.3 per cent .were found to have qualified to use the Rune Brand, a considerable improvement on the previous year. On the other hand, the results of the moisture tests were not so satisfactory. No

less than 15.3 per cent. of all creameries had to be placed in the highest class (15.1 to 16 per cent. moisture), and only 1.6 per cent. of them were graded in the 12.1 to 13 per cent. class. The proportion of creameries where pasteurization was unsatisfactorily done was 12.2 per cent., indicating lack of proper supervision. The quantity of butter which qualified to bear the Rune Brand was something over 34,000 tons, or rather less than in the previous year.

SEED POTATOES FOR JAMAICA.

In order to encourage the local production of potatoes, the Government of Jamaica imposed, in 1927, heavy duties on potatoes imported into the island for purposes of consumption. These duties amounted to 1d. per pound under the preferential tariff and 2d. per lb. under the general tariff. Seed potatoes, however, are allowed free entry under certain conditions, and since local potatoes are not suitable for seed, imports are likely to increase as long as the present duties remain in force. Importers must procure a permit from the local Department of Agriculture, authorising such importation, and each shipment must be accompanied by a disease-free certificate from the Department of Agriculture of the country of origin, and also on arrival be subjected to an examination by the microbiologist of the local Department of Agriculture. During the period September, 1928, to May, 1929, almost 1,000 barrels of seed potatoes were imported, 90 per cent. of which came from Canada, and the balance from Scotland.

PIG-RECORDING IN SWEDEN.

For the past six years, the Central Agricultural Experiment Station of Sweden have carried out a series of investigations into what they call the " use-value " of the pigs kept for breeding purposes at the Station. The right estimation of this " use-value " will, it is hoped, afford a scientific basis for the selection of breeding stock likely to produce the best type of offspring; in other words, the ideal bacon pig. The number of pigs under observation in 1928 was 252, divided into 63 groups. Of these groups, 12 were composed of pigs of the Swedish " farm breed," and 51 were composed of Yorkshire pigs.

The animals were fed on a mixture of concentrates consisting of 45 per cent. barley, 40 per cent. maize, and 15 per cent. wheat. To this, 10 per cent. of fish meal was added for groups whose average weight was under 88 lb. and 5 per cent. for groups whose average weight was between 88 and 121.1 lb. The skim-milk ration was proportional to the weight of the pigs and to the nutritive value of all food. Thus, pigs under 55 lb. received skim-milk equivalent to 35 per cent. of the nutritive value of all food; pigs between 55 and 88 lb., 30 per cent.; pigs between 88 and 121.1 lb., 25 per cent.; and pigs over 121.1 lb., 22.5 per cent. In addition, the smaller pigs received 5 grammes of bone meal per day, increased to 10 grammes as the animal grew larger. Pigs under 55 lb. also received 4 grammes of cod liver

oil every day. This dose was gradually increased to 8 grammes, and was reduced when the pigs reached the weight of 110 to 132 lb., and finally discontinued altogether.

The pigs, when killed, are subjected to an external examination, as the result of which they are judged according to the following five factors:—(a) grading in Classes I, II and III (15-40 marks); (b) consumption of food per unit of growth (5-20 marks); (c) loss at slaughter (5-15 marks); (d) quality of belly (5-15 marks); and (e) quality of hams (5-10 marks). Detailed records are kept, showing weight and age of pigs at different stages, number of food units consumed, slaughter results (thickness of back meat and fat, length of back, percentage of loss, fineness of head, skin and bone, shape and size of hams, etc.).

As a result of the judgings, the classification of the various groups in 1928 was as follows:—

		Swedish pigs.	Yorkshire pigs.
Class I	...	53.2 per cent.	55.0 per cent.
,, II	...	29.0 ,,	25.4 ,,
,, III	...	17.8 ,,	19.6 ,,

The question of the relation between the weight of sucking pigs at 3 weeks of age and their further development and slaughter results was specially studied. The results obtained showed that sucking-pigs which are heavy at 3 weeks will keep this lead during subsequent growth and will therefore take less time to grow and will consume less food per unit of added weight. A high milk-producing capacity in the mother sow, and consequent early development of the young pigs is of definite practical value.

SPRAYING APPLE TREES: DANISH EXPERIMENTS.

Bordeaux mixture, as a spray for scab in apples, though not in general use in Denmark, has been used there since 1896. Lime-sulphur spray has been used since 1911. Each of these sprays has its own advantages and disadvantages, and to test their comparative values, a series of experiments was begun in 1923 at the Danish State Experiment Station, Blengsted. In that year, the scheme of operations was as follows:—(a) unsprayed; (b) winter-spraying with lime-sulphur; (c) winter-spraying with lime-sulphur as under (b), and in addition, 5 summer sprayings, before and after flowering, and 3 sprayings with 2½% sulphate of lime at intervals of three weeks. The results obtained in 1923 were not very promising, so the programme arranged for 1924 to 1928 was as follows:—(a) unsprayed; (b) Bordeaux mixture, used as a summer spray, 4 or 5 applications. The proportions used were as follows:—1924-25: ordinary 2 per cent. Bordeaux mixture; 1926: 2 parts of lime to 1 part of copper sulphate; 1927-28: 1 per cent. lime to ½ per cent. copper sulphate; (c) lime-sulphur (2½ per cent. 30° Beaumé) used as a summer spray, 4 or 5 applications. In both experiments, an arsenical insecticide was applied prior to and after the flowering period.

Both sprays were found to have greatly increased the yield of fruit. Bordeaux mixture proved to be the best preventative for scab on leaves and fruit, and the yield was much greater than after the use of lime-sulphur. Several apple varieties, however, suffered considerable injury from the spray itself, especially in years when the early summer was wet and cold.

Lime-sulphur spray was not so good a preventative against scab, and it caused considerable injury to the leaves. In the case of several varieties, the leaves were scorched and the yield of fruit was consequently lessened. The fruit itself was finer, however, and it suffered but little injury from the spray. The price realised for it on the market was better than when Bordeaux mixture had been used.

MILLING OF NATIVE WHEAT AND RYE IN SWEDEN.

A voluntary agreement has been concluded between the Government of Sweden and the Swedish millers, in virtue of which the millers undertake to use Swedish wheat to the extent of an average of not less than 45 per cent. of all the wheat milled at each mill, and not less than 30 per cent. of each lot of wheat milled separately. Moreover, Swedish rye is to be used so as to amount on the average to at least 50 per cent. of the rye milled at each mill. Minimum prices are fixed for the wheat and rye to be purchased by the millers. The agreement might be denounced by the millers after the beginning of August, if a sufficient number of the millers favoured such denouncement, but apart from this, it was to remain in force until 15th September, 1930. The millers who signed the agreement subsequently declared themselves willing to increase the proportion of home-produced wheat and rye milled to 55 per cent. and 60 per cent. respectively of the total grain milled at each mill, in view of the large immediate offers of these cereals.

A Decree further provides for the admixture of Swedish produce with imported wheat flour and rye flour. Flour made from Swedish wheat must be mixed with imported wheaten flour so that the former represents an average of at least 45 per cent. of the entire mixed consignment as well as at least 30 per cent. of every such part of the consignment as is mixed separately, while flour made from Swedish rye must be mixed so as to represent at least 50 per cent. of the entire mixed consignment of rye flour. The mixing has to be carried out while the imported produce is still under the control of the customs.

DANISH EXPORT BUTTER TRADE, 1929.

The annual report of the Danish Wholesalers' Association states that the conditions which affect the export butter trade vary from year to year, and are determined chiefly by the purchasing power of the various importing countries, and also by climatic conditions which are often a deciding factor in butter production. The imposition of import duties too often proves an effective barrier against trade.

In the year under review, the purchasing power in both England and Germany (Denmark's principal customers) was undoubtedly less than it had been in 1928. In both these countries unemployment increased as the year went on. Butter consumption was also reduced, in Germany by the severe cold which closed many northern ports for some months, and in England by the extensive strike which took place in the Lancashire textile industry. Nevertheless, in spite of these and other adverse circumstances, the export of Danish butter to England and Germany in 1929 showed an increase over that of the preceding year by 7,800 and 2,500 tons, respectively.

Amongst the countries which have imposed an import duty on butter are:—the United States, Czecho-Slovakia, and Switzerland. In the two former countries and also in France and Belgium, it is chiefly unsalted butter which is imported. This class of butter commands a high price in the United States where it is used for making ice cream.

As regards butter production in general, the report mentions that, whereas in 1928 production was adversely affected by the poor hay harvest in many parts of Europe, it was on the whole favoured by climatic conditions in 1929, and in northern lands showed a big increase. In the southern hemisphere, on the contrary, climatic conditions were by no means so favourable to butter production.

Denmark's total butter export for 1929 amounted to about 3,098,000 cwts., as against 2,895,000 cwts. in 1928. The export to England, Germany, Belgium, France, United States and Czecho-Slovakia showed an increase over that of the previous year, while the export to Switzerland and Norway showed a decline.

DEAD POULTRY TRADE: DANISH REGULATIONS.

In pursuance of the Avian Tuberculosis Law of the 3rd March, 1930, the Danish Ministry of Agriculture have issued regulations governing the slaughter, inspection and branding of Danish poultry and poultry products.

Places where the poultry are killed for sale must be approved by the Ministry of Agriculture. When such approval has been given, the Ministry appoints a veterinary surgeon to inspect all poultry both before and after killing and generally to supervise the whole establishment. Poultry which have passed the veterinary inspection may be branded in red on the back with the official mark:—The Danish crown, the word " Danmark " and number of the firm, enclosed in a circle.

Control stations for the inspection of poultry killed elsewhere in Denmark may also be set up, subject to the approval of the Ministry. Only Danish poultry are allowed to be inspected. If passed, they are branded with a red triangular mark showing the crown, the word " Danmark " and the number of the Station.

Without one of these brands, no dead Danish poultry may be exported. A brand is also provided for preserved foods prepared from Danish poultry. It is similar to the brand for dead poultry, as described above, but has no enclosing circle.

FRENCH AND IRISH TURKEYS ON THE LONDON MARKET.

A commission of poultry experts was organised and sent to England by the Paris-Orleans Railway Company, to study the question of why the French turkey has declined so much in price and popularity on the London market. The report of the commission contains some interesting information. In so far as the French trade is concerned, the conclusion arrived at was that if French turkeys are to hold a place on the London market in the future, there will have to be a great improvement both in the conformation of the birds themselves and also in the methods of killing and packing them for market. Furthermore, it is recommended that only first-class firms should be authorized to export turkeys.

The report has many complimentary things to say of the Irish turkey, (which is described as being most sought after by buyers), and of the manner in which it is marketed. "In Ireland," says the report, "stock birds are selected for their long breasts and powerful muscles. Feeding is planned on rational lines, the dietary in the early stages being rich in nitrogenous matter, and this, in conjunction with selection, has facilitated the production of the excellent specimens marketed. The condition of the birds is generally better than that of the French turkeys, though the latter have finer and whiter skins."

French turkeys often show weakness, especially malformed breast-bones, which are caused partly by the practice of allowing the birds to roost in trees, and partly by a deficiency of lime in the diet. Apart from these accidental defects, local breeds in France are not all that could be desired, and the Commission recommend that Irish birds should be purchased in order to improve French flocks.

The manner in which Irish turkeys are packed for market is also the subject of much commendation, and the clean, fresh appearance of the paper with which the cases are lined suggested that the contents, when revealed, might well prove to be either bon-bons or confectionery, and not dead poultry.

THE DANISH MARGARINE INDUSTRY.

The latest official statistics show that the margarine industry in Denmark is steadily increasing, although the number of factories has not materially altered during the year. The industry has shown a remarkable development in the last ten years. The total number of margarine factories in 1913 was about 41; in 1918, on the resumption of work after the close of the war, the number rose to 50, and in 1929, it had risen to 141. Altogether, 1,239 persons—925 males and 314 females—are employed in these factories. The total amount of margarine produced in Danish factories in 1929 was upwards of 1½ million cwts. Nearly the whole of this output was marketed in Denmark, where the annual consumption of margarine per head of the population is something over 49 lb.

DUTCH EGGS: NEW MARKING REGULATIONS.

Under the Agricultural Exports Act, 1929, the Netherlands Government have promulgated two Orders, the effect of which will be to regulate more strictly the exportation of hen and duck eggs from that country. The Dutch export egg trade has hitherto been organised by private exporting societies, but, in future, the Ministry of Agriculture will exercise considerable supervision over the work and organisation of these societies. Their rules must receive the approval of the Ministry, and any alterations must also be submitted for approval, and the Ministry will nominate an advisory representative on the Committee of Management.

According to the provisions of the second Order mentioned, hen and duck eggs intended for export are graded in four classes as follows:—

I. "Fresh Dutch Eggs," which must be of Dutch origin, must not have been cold stored or otherwise preserved, and must show the well-known qualities of the fresh egg on being tested.

II. "Dutch Cold Stored Eggs";

III. "Dutch Preserved Eggs," and

IV. "Eggs," in general, which do not fall under any of the other three grades.

When exported to certain countries specified by the Ministry of Agriculture, eggs of the first three classes must be provided with a stamp showing the country of origin, and also with a stamp indicating the identity of the dealer and producer, but not more than two stamps may be applied to any one egg. The eggs must be sorted by weight and, when sent to the countries specified, the cases in which they are packed must bear an indication of the class, nett weight, and identity of the consignor. The cases too must conform to certain regulations. The rules regarding class IV. eggs are simpler. If exported, such eggs must be stamped with the name of the country of origin, and cases must bear an indication that the eggs are of the fourth class.

Under the new Order, egg cases must bear a "week-mark," indicating the week in which the eggs were packed. During the months of March, April, May and June, the words "intended for cold store" may be substituted for the week-mark. Finally, the National Mark, issued under the Act of 1929, which constitutes a proof that the goods in question are in conformity with the regulations, must be applied to egg cases before exportation.

INCREASING LATVIAN BUTTER EXPORTS.

An Order, the object of which is to increase the export of butter from Latvia, has been published in the Latvian "Gazette." Under this Order, the Ministry of Agriculture will give premiums to milk producers, who supply milk to butter factories which make butter for export and which are registered by the Ministry of Agriculture. For every kilo of first-quality

butter produced in the factories of Livonia, Courland and Zemgale, a premium of about 1.9d. is paid, and for every kilo of first and second quality butter made in the factories of Latgale about 2.85d. is paid. The nett weight of kegs of butter for which premiums are available is fixed at 50.8 kilos (about 1 cwt.). The total exports of butter from Latvia in 1929 amounted to 291,300 cwt.

CONTROL OF THE DAIRY INDUSTRY IN SOUTH AFRICA.

An Act entitled the Dairy Industry Control Act has been passed by the legislature of the Union of South Africa. Article 1 of the Act provides for the establishment of a Dairy Industry Control Board which is authorised, *inter alia*—(1) to impose a levy not exceeding one penny per lb. on all creamery butter, farm dairy butter, butter substitutes and cheese (other than cheese made for household consumption) manufactured in the Union, and on all butter, butter substitutes and cheese imported into the Union. With the Minister's consent a further levy not exceeding one halfpenny per lb. may be imposed; (2) to pay out from its funds to exporters of butter and cheese a bounty or premium (which shall vary according to the grade of the article or from which may be excluded any butter or cheese below a specified grade) not exceeding 6d. per lb. With the consent of the Minister a higher bounty may be paid; and (3) to control the export of butter and cheese generally, and to determine the quantity of butter or cheese which must be exported during a given period. Provision is made for the prohibition, by Proclamation, of the import and export of butter and cheese, except under licence, either generally or in the case of a particular place or country only. The provisions of earlier Acts relating to the importation and sale of margarine and the like are amended.

STATE CONTROL OF THE GRAIN TRADE IN HUNGARY.

A measure designed to raise the internal price of grain and to promote the marketing of the Hungarian harvest came into force in July, 1930. The Law provides that purchasers of grain must previously buy a grain ticket, the value of which is proportionate to the quantity of grain to be purchased and was fixed provisionally at 3 pengo per 100 kilos (about 1s. 1d. per cwt.). Grain tickets must be purchased also in respect of all grain and grain products imported from abroad. The grain ticket is divided into two parts (a grain ticket proper and a coupon), of which the coupon is surrendered by the purchaser to the producer or, in the case of imported grain, to the Customs Authorities, while the grain ticket remains in the hands of the purchaser and is passed on at each future transaction to the new owner.

A grain marketing fund is to be established, from which will be refunded the value of the grain coupons not used by the producer in payment of his taxes, and also the value of the grain tickets held in respect of exported grain. The fund is also to be used for the amelioration of Hungarian agriculture in general.

Regulations are laid down regarding grain mortgages and credits of crops sold before the harvest, " green credits," as they are called.

The Law prohibits, in general, dealings in grain for future delivery except by special authorisation. The Government are also empowered to make rules for the milling of grain and the proportion of wheat and rye flour to be used in baking.

GRAIN CONTROL REGULATIONS IN LATVIA.

Regulations which came into force in August, 1930, empower the Latvian Cabinet of Ministers to issue orders regulating the proportions of foreign and local grain (rye and wheat) to be used in milling. The locally grown grain hitherto stored at or pledged to the Latvijas Banka is to be received into the State granaries, and advances may be made upon it to farmers at rates not exceeding minimum prices for grain so pledged, which will be fixed by the Cabinet, taking into account the costs of harvesting, etc. Rye and wheat and their products can in future only be imported by purchasers of an approved proportional amount of local grain from the State-controlled granaries. The necessary certificates will be issued by the Latvian Ministry of Agriculture.

WARBLE CONTROL EXPERIMENTS IN WORCESTERSHIRE.

A report on the results of a series of experiments on the control of Ox Warble Flies is contained in the annual report for 1929 of the Agricultural and Horticultural Research Station, Long Ashton, Bristol.

The experiments were initiated by the Agricultural Education Sub-Committee of the Worcestershire County Council, and were carried out on 16 farms in that county. The object was to discover whether an effective and cheap control treatment could be found. At the first visit, on 19th March, the following particulars were noted:—

Number of herds	16
Number of cattle	311
Number of warbles	1,163
Average number of warbles per head	3.75
Smallest total number present in one herd ...	18
Largest number on any one animal at one time ...	54
Cattle free from warbles throughout experiment...	65

The following materials were tested:—

A. Iodoform Ointment (1 part iodoform, 5 parts soft paraffin).
B. " Warble Fly Ointment," a proprietary preparation stated to contain some of the active ingredients of Derris root.
C. Pyrethrum + rape oil (4 per cent. pyrethrum).
D. Derris (as " Polvo ") + soap (Derris 1 lb., soft soap ¼ lb. and water 1 gallon).
E. Proprietary preparation.
F. Proprietary preparation.

The results obtained with these six materials were as follows:—Iodoform Ointment: For some reason, not apparent, did not give such good results as expected; the odour also is objected to by stockmen. "Warble Fly Ointment": except for some trouble in application during the colder weather, and where the cattle had very heavy coats of hair, this method was excellent; the warble mortality was 100 per cent., and the cost very low. Pyrethrum + rape oil: This application also failed to give the results hoped for, and the presence of oil (in this or the other dressings) was undoubtedly unfavourable in action, since it prevented the grubs—even if killed—from drying up after death. Derris (as "Polvo") + Soap: This was the most successful method employed; the "kill" was 100 per cent.; application was perfectly easy; there was no objectionable odour or other drawback. The cost was low, working out at 1d. per head of stock for four dressings. Proprietary Preparation E.: This gave a high death rate of grubs and was otherwise excellent. The cost, however, was very high. Proprietary Preparation F.: This was less expensive than E. and possessed good killing properties. Being oily, however, it showed drawbacks similar to preparation C.

The report concludes by stating that complete eradication can only be accomplished by systematically killing the warbles in the backs of the animals before they mature and drop out alive. The choice of the killing agent lies between ointments and liquids; other methods are not advised. Oily remedies tend to preserve the grub, instead of drying it up. Derris-soap is an efficient killing agent; dressings should be given four times during the season. This method has been adopted by the Leathersellers' Company's Warble Fly Committee as the most efficient and economical at present available, and it is to be employed in numerous large-scale trials and demonstrations during 1930.

THE AGRICULTURAL CRISIS IN DENMARK.

The Agricultural Economics Bureau, Copenhagen, have issued their preliminary report upon the profitableness of Danish agriculture during the year 1929-30. The report is based on information collected from 200 Danish farms. The gross receipts during that period averaged 857 Kr. per hectare (£18 17s. 9d. per acre) or 13 Kr. less than they were in the previous year. For crop products, the decline amounted to 24 Kr. the hectare, whilst for animal products a rise of 11 Kr. is recorded. Though the grain crop was just as heavy in 1929 as in 1928, the increased number of pigs kept in the former year reduced the amount available for marketing and this, in conjunction with a big fall in grain prices, caused the sums realised by the sale of grain to be only half what they were in 1928. The amounts realised by the sale of sugar beet and potatoes also showed a decline and the drop in gross receipts was therefore most marked on farms over 125 acres in area, these being the farms which are mainly given to the growing of grain and sugar beet.

The fall in the price of butter also served to bring down the gross receipts

arising out of the live stock industry, but the rise in bacon prices served to counteract this to some extent, especially in the case of small holdings under 25 acres. Working expenses were practically unchanged, wages being slightly higher, and prices of fertilisers rather lower, than in the previous year. The total outlay per hectare amounted to 713 Kr. as compared with 710 Kr. in 1928 (£15 14s. 3d. and £15 13s. 0d. per acre respectively). The final result is that the average nett receipts for all farms fell from 160 Kr. per ha. (£3 10s. 6d. per acre) in 1928 to 144 Kr. (£3 3s. 6d. per acre in 1929); in other words, the interest on agricultural capital fell from 6.5 per cent. to 5.8 per cent.

The total agricultural capital invested was 49 Kr. more per ha. (21s. 7d. per acre) than it has been in 1928, owing to the increase in numbers and value of farm stock, especially of pigs. The general trend has thus been a downward one and, as there has been a further decline in prices during the present year, it may be regarded as tolerably certain that the year 1930-31 will show even more unfavourable results.

THE IMPERIAL CO-OPERATIVE UNION OF GERMANY.

In February, 1930, the much-debated coalition between the two big agricultural co-operative organisations in Germany—the "Reichsverband" and the "Raiffeisen Verband"—was completed, and the new body, known as the Imperial Union of Agricultural Co-operative Societies, have issued their first report which embraces for the first time in a single volume an account of practically the whole agricultural co-operative movement in Germany. This account covers the period of transition which preceded the final unification, and for this reason the particulars given are still arranged in two separate sections relating respectively to the two original organisations.

To the new Union are affiliated 36,990 out of 40,901 agricultural co-operative societies existing in Germany; in other words, about 89 per cent. of the total number. These societies are grouped in 33 provincial unions. The number of Central Societies is 123, of savings and credit societies 19,828, of purchase and sale societies 3,784, of creameries 3,706, and of other miscellaneous societies 9,158.

The banking side of the movement is in a very satisfactory state, and the report mentions that, for the first time since the German currency was stabilised, the assets of affiliated societies in the hands of the central banks exceed considerably the liabilities of these latter towards the Prussian Bank and other big banks.

The co-operative creameries handled in 1929 one-fifth of Germany's total milk production. The co-operative cattle marketing societies passed 1,734,354 head of cattle through their hands, to the value of over 295 milliom RM., or nearly £15,000,000. The co-operative sale of eggs is in the hands of 17 societies and has established wholesale markets in Berlin and Cologne.

CHINESE TRADE IN EGGS AND EGG PRODUCTS.

An important export trade in egg products has been developed in China. The egg industry in that country is of but minor interest to the Chinese themselves, and for this reason, they have always neglected it. The result is that poultry-keeping is still run on very primitive lines, and the trade in egg products is largely in the hands of German firms. The products marketed consist of:—(a) " Whole eggs " (consisting of both yolk and white), and (b) Yolks, and (c) Whites, separately. All three products are sold both in dry and in liquid form. The egg factories are situated chiefly in the Yangtse Valley, and the principal ports are Hangkow and Shanghai. Northern China also has a considerable output, which is shipped, via Tientsin and Tsingtau, mainly to England. Other customers are America, France and Germany.

Besides her trade in egg products, a considerable export trade is done in fresh eggs. In 1928, 612 millions of these eggs were exported from China. One-half of these eggs went to Japan, but the export to Europe is increasing. There can be scarcely any doubt that larger and larger quantities will find a sale in Europe, according as refrigerator facilities are extended.

WHEAT-GROWING CAMPAIGN IN ITALY.

The special wheat-growing campaign known as the " Battle of the Wheat," which has been carried on in Italy during the past few years, has yielded excellent results. Without any increase in the area sown, the amount of wheat produced in 1929 was increased to nearly 7 million tons, as compared with some 6 millions in 1928 and 5 millions in 1927. The area under wheat was in fact less by some 400,000 acres than it had been in the previous year, but the yield per acre has been increased from some 6 or 7 cwts. to 11.5 cwts.

It is interesting to note that, while Italy's wheat production has been increasing, her production of sugar beet, while improving slowly in quality, has declined in quantity. In the period 1899 to 1903, the average sugar content of Italian beets was 12.69 per cent.; in the period 1924 to 1928 it was 14.79 per cent. On the other hand, the weight of beets produced per acre was greatest from 1909 to 1913, being then 13 tons per acre. From 1914 to 1918, the average yield per acre fell to 9.9 tons, and after again rising to 11 tons, it has fallen to 10.2 tons in the period 1924-28.

The causes which underlie this decline in production are difficult to determine, but as in the case of wheat it is hoped by better methods to achieve heavier crops of sugar beet in the future.

GERMANY AND THE COLORADO BEETLE.

German agricultural journals are drawing attention to the ever-present menace of the Colorado beetle in France. They declare that since the Beetle has spread from 5 to 14 Departments in France, the danger of its

invading Germany is becoming more imminent, and that extra precautions are necessary. Consequently, if larvæ are discovered or if the presence of beetles on a farm is suspected, such information must immediately be communicated to the police of the district, so that preventive measures may be taken at once. Moreover, the competent Heads of the Plant Protection and Biological Institute for Agriculture and Forestry in Dahlem, near Berlin, must be informed. Anyone neglecting to give information renders himself liable to punishment.

DANISH DAIRYING STATISTICS, 1929.

The 33rd annual report on Danish dairying statistics, which relates to the year 1928-29, differs in some respects from its predecessors. The arrangement of the material has been altered in several respects, and the report now includes particulars of Danish butter prices which have heretofore been the subject of a separate report. The object of these dairying statistics is of course to throw light upon the present position of the Danish dairying industry, and in its new form the report has been welcomed as a distinct improvement on its predecessors. The principal averages recorded are the following:—

	1928-29	1927-28
Number of members per creamery ...	148	145
Number of cows per creamery ...	1072	1025
Milk yield per cow	664 galls.	644 galls.
Fat-content of milk	3.70%	3.65%
Milk used to make 1 lb., butter ...	23.6 lb.	24.0 lb.
Total milk handled per creamery ...	3270 tons	3003 tons
Working expenses per 100 galls. milk ...	6s. 6d.	6s. 9½d.
Butter price per lb.*	1s. 6¾d.	1s. 7d.
Nett receipts per gall, milk handled ...	9d.	9d.

The statistics indicate an increase in the average number of cows per creamery, a rise in the average milk yield per cow, and in the percentage of fat units, and also in the average quantity of milk handled per creamery. Working expenses have fallen somewhat, but so has the price of butter, so that nett receipts have remained as they were. The number of creameries which use the fat-unit method of calculating milk prices has shown steady progress and is now 70 per cent. of the total number, while the cream-units method still obtains in 28 per cent. of the creameries which furnished reports. The following table shows that the position in this respect has been completely reversed in the course of the past five years:

Method	1924	1925	1926	1927	1928	1929
			percentages			
Fat-units ...	23	31	40	46	59	70
Cream-units ...	67	61	54	48	38	28

Motor lorries have been increasingly used for the transport of milk; this is a great step forward, both for the supplier and for the creamery, since

the time required to transport the milk is reduced to a minimum. The supplier can start work at a later hour in the morning, and gets back his skim-milk earlier, while the creamery gets fresher and better milk. Of the total quantity of sweet milk, 96.4 per cent. was used for butter-making and 2 per cent. for cheese-making, while 1.6 per cent. was sold as milk. Of the skim-milk, 92.7 per cent. was given back to the suppliers, 4.7 per cent. was used for making cheese, and 2.6 per cent. was sold.

Working expenses were 4 per cent. less than in the previous year; they have indeed fallen so low that any further reduction is scarcely to be expected. The statistics show that the working costs of small creameries are considerably higher than those of large creameries, the difference amounting to 36 per cent.

INCREASED BUTTER TRADE IN EASTERN EUROPE.

The remarkable development which has taken place in the export of butter from the Baltic States, Finland and Poland during the past ten years or so is indicated by the following table which shows the percentage of the world's butter-trade which fell to each of these countries in the years mentioned:

Year	Finland	Estonia	Latvia	Lithuania	Poland	Total
1909-13	... 3.7	—	—	—	—	—
1921	... 3.2	0.1	0.0	0.0	—	3.3
1922	... 2.6	0.3	0.3	—	0.0	3.2
1923	... 2.0	0.7	0.9	0.1	0.0	3.7
1924	... 2.0	0.8	0.9	0.1	0.0	3.8
1925	... 2.9	1.5	1.6	0.2	0.1	6.4
1926	... 2.9	1.9	2.3	0.4	1.2	8.8
1927	... 3.1	2.0	2.2	0.4	1.5	9.3
1928	... 2.7	2.2	2.6	0.5	2.2	10.2
1929	... 3.3	2.9	2.5	0.8	3.0	12.5

Soviet Russia, the largest butter exporting country in Eastern Europe, is not included in the table, the reason being that the peculiar conditions now prevailing in Russia make comparison with other countries as regards production impossible.

EFFECT OF CONCENTRATED FOODS UPON BUTTER CONSISTENCY.

In order to determine the effect which the diet of the dairy cow may exercise upon the chemical composition of butter-fat, and hence on the consistency of the butter, a series of experiments were carried out at the Danish State Farm at Hilleröd during the winter of 1927-28. In addition to a basic ration of 79.2 lb. of roots, 4.4 lb. of hay and 8.8 lb. of straw,

the following quantities of concentrated foods of different kinds were fed to 14 groups of dairy cows:—

Group 1: 4.9 lb. linseed cake.
,, 2: 4.9 lb. decorticated Texas cotton-seed cake.
,, 3: 4.9 lb. crushed soya.
,, 4: 3.7 lb. soya cake.
,, 5: 4.8 lb. earthnut cake.
,, 6: 2.3 lb. sunflower cake.
,, 7: 5.5 lb. crushed sunflower seed.
,, 8: 3.6 lb. rape cake.
,, 9: 5.8 lb. cocoanut cake.
,, 10: 7.1 lb. palm kernel cake.
,, 11: 6.3 lb. wheaten bran.
,, 12: 6.1 lb. mixed pease.
,, 13: 5.1 lb. maize.
,, 14: 7.3 lb. dried mash.

The milk from these different groups of cows was kept separate and was made into butter at the experimental dairy, after which the 14 samples of butter were tested for consistency. The investigation, which lasted from 1 to 2 months, yielded the following results:—

(1) Palm nut cake, cocoanut cake, soya cake and mixed peas gave a dry and crumbly butter.

(2) Rape cake, cotton-seed cake, soya cake, earthnut cake, wheaten bran and maize gave a butter of about normal consistency. Maize butter was, however, slightly short and crumbly.

(3) Sunflower cake and linseed cake gave very moist and soft butter.

The result of the inquiry, says the report, was to show that the choice of concentrated foods may exert a great influence upon the consistency of butter. When mixed concentrates are fed to dairy cows, the consistency and general quality of the butter must be carefully watched, as this of course will decide its market value. It must not, however, be supposed that only one kind of concentrated food should be used. Where a mixture is found to produce butter which is dry and crumbly, some of those foods should be added which tend to make butter soft and moist, taking care at the same time to see that the cows receive, over and above their maintenance ration, about 0.4 food units and about 60 grammes of digestible crude protein per 2.2 lb. of milk containing 4 per cent. of fat. The final report states that as a result of the tests made, the various feeding-stuffs were classified as follows:—

Group A:—Feeding-stuffs which produce a soft, loose-textured butter, having an iodine index of over 35, are:—dried maize mash, sesame cake, soya beans, sunflower cake, hempseed cake and rape cake. **Group B**:—Feeding-stuffs which yield a butter with iodine index ranging from 29.4 to 34 and a normal consistency. These are: earthnut cake, dried potato pulp, dried mash, fish meal, tapioca meal, soya meal, mixed grain, mangels with tops, blood meal, sunflower meal, wheaten bran, and oats. **Group C** includes feeding-stuffs which may be used without injury to the consistency of butter, when they are taken along with suitable quantities of the feeding-

stuffs in Group A. These foods include maize, barley, rye bran, coconut cake, soy meal, palmnut cake, rye, wheat and mixed leguminous seed. Barley and maize take a middle position, as they yield a butter which, though not specially dry, is (in the case of maize) of a loose, crumbly structure.

DATE-STAMP ON DANISH BUTTER CRITICISED.

The Danish system of marking the date upon butter packages has been the subject of considerable criticism ever since its introduction in 1926. In the course of a letter to the Danish journal, "Smörtidende," a German wholesale butter merchant makes a strong attack upon the date-mark, which he says is largely responsible for the present low price of Danish butter. He points out that the foreign buyer orders a certain quantity of Danish butter, not too much, since he risks a loss, thanks to the date-stamp, should any portion of the butter not find an immediate sale. Of the whole consignment, 50 per cent. will probably be sold at once, but as regards the remainder, difficulties due to the date-stamp will be sure to arise. The retailer, who formerly relied chiefly on his sense of taste and smell in judging butter, now merely looks at the date-stamp and finding, perhaps, that this is a shade older than the stamp on the butter offered by the next-door dealer, declares that the butter is "old" and takes his custom elsewhere. Thus the wholesale merchant has often to clear out much of his butter at a sacrifice in order to make way for the next consignment, and all because of the date-stamp. The writer of the letter urges the abolition of the date-stamp system, and says that if it were gone, Danish butter would fetch a higher all-round price than it does at present, and one which would be more in keeping with its actual quality.

CULTURAL TESTS WITH SUGAR BEET IN FRANCE.

The results of the cultural tests carried out in 1929 by M. Emile Saillard in the laboratory of the French sugar manufacturers with 13 varieties of sugar beet on 10 different plots were as follows:

I. Classified according to percentage of sugar, the different varieties were listed as follows:

		per cent.
1.	Kühn	18.13
2.	Dippe W.I.	18.09
3.	Sébline	17.93
4.	Hilleshög	17.85
5.	Desprez	17.82
6.	Rabbetge and Giesecke N.	17.80
7.	Martin	17.75
8.	Maurus Deutsch B.A.	17.72
9.	Zapotil	17.62
10.	Vilmorin B.	17.52
11.	Legland R.	17.51
12.	Buszczynski	17.49
13.	Mennesson B.	17.01

II. Classified according to sugar production in kilos per hectare, the order of varieties was the following:

		Kilos.
1.	Vilmorin B.	5,952
2.	Buszczynski	5,915
3.	Dippe W.1	5,909
4.	Rabbetge and Giesecke N. ...	5,876
5.	Hilleshög	5,698
6.	Martin	5,663
7.	Desprez	5,605
8.	Mennesson B.	5,516
9.	Maurus Deutsch B.A.	5,507
10.	Sébline	5,471
11.	Kühn	5,456
12.	Legland R.	5,417
13.	Zapotil	5,394

III. Classified according to total yield of beets, in kilos per hectare.

		Kilos.
1.	Vilmorin B.	33,975
2.	Buszczynski	33,820
3.	Rabbetge and Giesecke N. ...	33,015
4.	Dippe W.1	32,670
5.	Mennesson	32,435
6.	Hilleshög	31,920
7.	Martin	31,910
8.	Desprez	31,460
9.	Maurus Deutsch B.A.	31,095
10.	Legland, R.	30,940
12.	Zapotil	30,590
12.	Sébline	30,430
13.	Kühn	30,095

Note.—100 Kilos equal 1.97 cwt.

AVIAN TUBERCULOSIS TESTS IN DENMARK.

Under the provisions of the Avian Tuberculosis Control Act, passed on 31st March, 1930, a maximum sum of 20,000 Kr., or rather more than £1,100, is placed annually at the disposal of the Danish Ministry of Agriculture, for the purpose of grants in aid of tuberculin tests carried out as a diagnostic control measure against avian tuberculosis. The grants may be made only in the case of poultry-keepers who are prepared either to kill off tuberculous birds or to isolate them in a manner approved by the Ministry, not only from the healthy fowl, but also from cattle and pigs, if such animals are kept. For the present, at least, only adult birds will be subjected to the test.

In making grants, preference will be given to flock owners who: (a) keep recognised breeding-centres, (b) supply certain recognised poultry abattoirs, (c) are suppliers of such pig abattoirs as have taken steps to stamp out tuberculosis, or (d) own herds of cattle which are either free from tuberculosis, or carry out State-aided tuberculin tests under the terms of the Law of 5th February, 1904.

Applications for tuberculin tests of poultry must state the nature and number of the fowls kept, their general condition of health, and the name and address of the veterinary surgeon who is to carry out the test. The applicant must also sign a declaration stating his willingness to kill off any birds which may react, or to isolate them from the rest of the flock.

REGULATION OF THE FRENCH EGG TRADE.

Some years ago, the question of regulating the egg trade was under consideration by the French Ministry of Agriculture, but owing to the difficulty of finding a satisfactory definition for the terms: "fresh egg" and "Preserved egg," nothing was done and the matter appears to be still under consideration. The practice of the French courts however is to hold that under the designation of "egg," dealers must sell only fresh eggs, i.e., eggs which have not been subjected to any special preserving process and which show no signs of alteration. Special police regulations govern the sale of preserved eggs.

The question of the compulsory marking of imported eggs with the name of their country of origin, as is practised in several countries, is now engaging the attention of the French authorities. Pending legislation on the subject, the Minister for Agriculture has issued a Circular to his officials in which he points out that a clear distinction between home and foreign eggs can even now be achieved under the Act of 1st Aug., 1905, which empowers the authorities to require that imported eggs shall be sold under some label or description indicating their foreign origin. French eggs, being unmarked, would be instantly recognisable. The Minister points out that enforcement of the existing law will have the advantage of preparing the way for the stricter legislation now contemplated, and he requests his officers to bring to the notice of dealers their obligations under the Act of 1905, and in the event of their disregarding such notice, to furnish a report with a view to the taking of legal proceedings.

IRISH HORSES AS ARMY REMOUNTS.

The army horse has lately been the subject of extensive discussion in a leading Danish veterinary journal. A special article was devoted to the Irish horse, and was based upon a lecture delivered in Berne by Colonel Ramelet, V.S., who described in detail the methods of examining, buying, shipping and training Irish horses as remounts for the Swiss army.

The Swiss buy two distinct types of horses in Ireland: (1) Officers' chargers, and (2) Troopers. The price given for troopers is about one-third

less than that paid for chargers. The type of remount bought is described as energetic, enduring, long-lived, clever at all paces, easy to train for saddle or draught, and of a nature which suits the Swiss people. The Irish horse is considered to be eminently suitable for the purpose in view, whilst at the same time it is not unduly expensive.

In view of the fact that the Danish army also purchase remounts in Ireland, the Danish writer begins his article with a very full summary of Colonel Ramelet's lecture (published in the Schweizer Archiv, H. 11 Dec., 1929). He points out that it is a matter of importance for Denmark, as it is for Switzerland, to secure suitable army horses at a moderate price. As regards type, the requirements of both countries are somewhat similar, but the Danish cavalry require as a rule better-bred horses, rather like those supplied to the Swiss officers. At the same time, a certain number of the trooper class of animal are bought for use in the artillery or in the machine-gun corps. The reason why the Danish cavalry need better-bred horses is that speed is the deciding factor in a flat country like Denmark.

The Danish method of purchasing is much like the Swiss, but Irish horses are only bought once a year. The percentage of rejections is about the same in each case. There is, however, one important difference; in Denmark, the new remounts go direct to the regiments, whereas in Switzerland they go first to a remount depôt where they are rested after the journey, become acclimatised, and receive some preliminary training before being distributed to the various army divisions. The advantages of this system are obvious.

BEET-DRYING IN RUSSIA.

Dr. C. Zuckermann (writing in the journal of the German sugar industry) states that seven experimental beet-drying plants were at work in Russia during the 1929-30 campaign. The dried slices were very poor in quality as they had been generally obtained from frozen beets, and contained a great deal of reducing materials, due partly to the frost and partly to the method of drying.

The best slices were produced by the de Vecchis method, although (owing to the complicated construction of the plant) these slices contained many broken scraps and much dust. The slices made by the Owen and Zins methods were very irregularly dried and portions of them were burnt and caramelized, and they also contained sulphur.

In order to collect material over an extended period, dried slices were prepared last spring in a special factory known as the Derjugino factory where experiments are usually carried out. It is, however, by no means a modern factory, and is unsuited for accurate scientific work. As the drying did not begin till the spring, and as the slices had been stored for several months, their quality was uneven and direct polarisation in the laboratory was higher than the polarisation after inversion, the difference ranging from 0.5 to 1.6 per cent., whereas with invert sugar in dry slices, the contrary should have been the case. It is hoped that better results will

be obtained next season, when the necessary improvements have been made in the drying-plant.

Dr. Zuckermann observes that the relatively short experiment of this year does not show that the drying of beet slices presents any real difficulty. The essential question is that of producing good slices, uniformly dried. If this problem is solved, the Russian reports would encourage the hope that good, white sugar should be obtainable from dried beet slices just as it is from fresh slices.

WORK OF THE IMPERIAL INSTITUTE.

The work of the Imperial Institute covers a wide field, and is of particular interest to the Colonies and Dominions, at whose request indeed much of it is carried out. The Annual Report for the year 1929 shows that the field of work is still extending. A large staff of scientific experts, working in specially equipped laboratories, carry out systematic tests of a great variety of colonial products and advise as to their preparation and marketing to the best advantage. Amongst the principal products tested and reported upon are: timbers, tobacco, rice, oils, hides and fibres, whilst a host of others: ginger from Nigeria, otto of roses from Cyprus, cassava starch from the Sudan, mohair from Australia, testify to the variety of articles studied and tested. Besides this scientific research, a great educational work is carried out by the Imperial Institute. Their exhibition galleries in London contain exhibits of the products of the various Dominions, and lectures to school children are given there from time to time. Nearly 400,000 persons visited the galleries during the year, and special school classes to the average number of 80 per week were conducted there. The number of children who visited the exhibition was 76,000 in the year under review.

ELM TREE DISEASE IN FRANCE.

This disease, reported first from Holland and Belgium towards the close of the Great War, is stated to have spread in France with such rapidity that hardly any districts remain immune, and the damage caused is such as to arouse grave misgivings concerning the future of the elm tree in that country, a somewhat serious matter, since its timber is much in demand for various industrial purposes, and the tree itself is a favourite for purposes of roadside planting.

The elms which have most suffered are those along public roads and canals, owing possibly to weaker powers of resistance due to indifferent soil conditions, to the injuries to which such trees are exposed, and to the attacks of certain insects. In Lorraine, where the disease appeared five or six years ago, the elms along the main roads and the Marne-Rhine canal are nearly all dead or dying. The same is true of certain other roads and canals, and there is hardly a town in France but laments the loss of the fine old elms which formerly adorned its public promenades.

The disease, however, also attacks trees which, from their favourable

conditions of growth, would seem likely to be able to withstand its onslaughts. Such trees are in arable lands, plantations, hedgerows, and forests.

The causes of the elm tree disease seem to be pretty well established. Researches have shown the causal agent to be the fungus called Graphium ulmi, which is carried to the tree by the insect known as Scolytus (the elm-bark beetle) which carries the spores of the fungus to the small upper twigs of the elm, and into the galleries which it bores under the bark of the tree. The only way in which the elm disease can be controlled is by waging war on the scolytes insects, felling all trees in which they have settled, and burning all bark in which they have found a lodgment. The difficulty of putting these control measures into practice will be very great in some cases. The relative susceptibility of the different types of elm is still rather uncertain, but observations made in Belgium indicate that certain hybrid types possess comparative immunity.

NEW REMEDY FOR LIVER FLUKE.

At a recent session of the French Academy of Agriculture, Professor Marotel, of the Veterinary College, Lyons, read a paper on a new remedy for liver fluke, the use of which he recommended on the grounds that it is cheaper than male-fern extract, and also easier to administer. The cost of male-fern extract works out in France at from 1s. 8d. to 3s. 4d. per sheep; the new remedy costs but 4d. It is a complex product based on benzol and oil of turpentine. Put up in capsules, it is very easy to administer. It has been tested by Professor Marotel with complete success. All traces of the eggs of flukes disappeared in three or four days, and the animals suffered no discomfort after treatment. To be completely effective, the remedy should be given three times during the season, as follows:—(1) before the sheep are put out on grass, about the month of April, in order to expel flukes and prevent them from being spread about the pasture; (2) five months later (about September) because this is the time taken for the eggs to become mature adult flukes; and (3) two or three months later (about November) after the sheep are brought in, to destroy any flukes which may have been swallowed since the second dose. This method of treatment: *before*, *during*, and *after*, the pasture season is, says Professor Marotel, a sure means of destroying flukes, both in the animal's body and on the grass.

INOCULATION AGAINST FOOT-AND-MOUTH DISEASE.

The question whether an attack of foot-and-mouth disease confers immunity against a second attack has been much debated. In a paper read before the French Academy of Agriculture, Professor Lignières gave an account of what has already been accomplished along this line of inquiry, and described a vaccine which he himself had prepared and which he was anxious to test on a large scale. This vaccine contains the living virus of the disease. The dose is 1 cub. cm. for large animals, and is given

twice with an interval of 8 or 10 days. The conclusions arrived at by Professor Lignières as to the question in general are as follows:—

Foot-and-mouth disease is one which confers a strong immunity against the type of virus which gave rise to it.

This immunity disappears with time, but usually lasts about a year. A number of early relapses have been observed, which may be explained by a multiplicity of viruses which do not act as vaccines one against the other.

Nevertheless, repeated infections frequently seem also to be capable of causing relapses.

Serotherapy working with a polyvalent serum may render an important service in the struggle against foot-and-mouth disease.

Vaccination is more useful still because it confers a longer immunity; it must also be polyvalent. Appropriate sanitary steps should be taken to protect the animals against infections which are continually being renewed.

Systematic research has revealed a new method of vaccination against foot-and-mouth disease, and efforts are being made to demonstrate its efficacy experimentally.

If, as is hoped, the experiments confirm that efficacy, the method of preparation will be revealed so that the vaccine can be administered everywhere.

RELATIVE PRODUCTIVE CAPACITY OF GERMAN FARMS.

The services rendered by the various sizes of holding as suppliers of the German market with agricultural produce has been the subject of a recent inquiry which embraced all holdings over 12½ acres in extent. The holdings were classed in three groups: small (12½ to 125 acres), medium (125 to 250 acres), and large (over 250 acres). As a result, it was found that 51.2 per cent. of all products was supplied by small holdings, 27.7 per cent. by medium, and 21.1 per cent. by large holdings. The percentage distribution of the principal products was as follows:—

	Cereals.	Potatoes.	Cattle.	Pigs.	Milk.
Small holdings ...	39	40	60	62	50
Medium holdings ...	31	28	28	27	33
Large holdings ...	30	32	12	11	17

RESULT OF COMPULSORY BUTTER TESTS IN DENMARK, 1929.

The number of butter samples called up and tested in 1929 was 5,421. The moisture content averaged 14.58 per cent. Of the 1,604 participating creameries, seven forfeited their right to use the Lur Brand, but two regained it before the close of the year. Of the butter produced, 93.9 per cent. was reckoned first-class, 5.3 per cent. was inferior, and 0.8 per cent. was poor in quality. 89 per cent. of the butter was exported, and only 11 per cent. was retained for the home market.

CONTINUED SPREAD OF POTATO BEETLE IN FRANCE.

In the course of a report upon the occurrence of insect pests in France during the year 1930, mention is made of the Colorado or potato beetle which has considerably extended its ravages in the south-western Departments. Notwithstanding the efforts made to restrict the contaminated zone, each year sees further encroachments into neighbouring districts. The report states, with regret, that notwithstanding the grave danger which menaces the whole of France, some municipal authorities, under the cloak of political considerations, actually forbear to notify the presence of the pest in their territory. This very improper course of action is dictated by the fear lest the Order prohibiting the movement of potatoes should be applied. Even in the actual infested zone, press campaigns are carried on with a view to obtaining some relaxation of restrictive measures which are of an absolutely indispensable kind.

The extension of the plague this year gives rise to the fear lest, in spite of all control measures, a few years hence will see the Colorado beetle established in every potato field in France. The report adds philosophically, " we shall have to get used to it and, as in the case of the vine phylloxera we shall have to spray our potato crops with some suitable insecticide. The result will be an increase in the number of persons employed in cultivating an equal area (with labour already so scarce!) and a considerable rise in the price of potatoes which are an article of prime necessity."

REGULATION OF THE EGG TRADE IN BELGIUM.

Under an Order of the Belgian Ministry of Agriculture, dated 13th November, 1930, hen and duck eggs in shell imported into Belgium must bear a mark showing the country of origin. Without this mark, eggs may not be sold or offered for sale or brought across the frontier, unless with special authorisation. Small lots of less than 100 eggs may, however, be imported without being marked, and eggs imported for the purpose of preserving are also exempt. Applications for such exemption must be made to the Ministry.

A further Order, dated 3rd December, 1930, provides for the marking of Belgian eggs intended for export with a special mark showing their Belgian origin. The mark consists of a label, obtainable from the Ministry of Agriculture. This label is to be affixed to one end of the egg-case. Exporters, who must be approved by the Ministry, must also affix their own identification number to all cases of eggs exported.

PIG-BREEDING IN THE NETHERLANDS.

A report on pig-breeding in the Netherlands, which has been furnished to the Danish Government by their representative in Rotterdam, states that the industry has undergone a considerable change and is much less remunerative than it was some months ago. Prices of sucking-pigs have

fallen greatly, chiefly because pig-fattening is no longer so profitable as formerly. The price of pork has also fallen as a result of the fall in prices of feeding materials. Thanks to the exceptionally low price of the latter, pigs have not been fed at an actual loss. The following index figures show the movement of prices in the three months, September to November, 1930. The average price for the period 1924-29 is taken as equal to 100.

	September.	October.	November.
Maize	62	55	46
Rye	45	43	40
Barley	47	45	41
Pork	82	75	69

Although steps have been taken in some places to reduce pig-breeding, the industry generally is in full swing. The average number of sows served was 10 or 15 per cent. greater than at the same date last year, and the same is true of the number of sucking-pigs. As compared with last year, the numbers of pigs over 6 weeks old and weighing less than 132 lb. increased by 15 per cent., of pigs between 132 and 220 lb. by 30 to 40 per cent., and of pigs over 220 lb. in weight by 10 per cent. Health conditions were good.

COMPULSORY REDUCTASE TEST IN DANISH CREAMERIES.

At the suggestion of the Danish Creameries' Association the Ministry of Agriculture in Copenhagen have issued a Circular to all creameries entitled to use the Lur Brand, stating that, for the manufacture of butter and cheese only "good, well-handled milk" may be used. Milk so described is defined as milk which does not vary from the normal in colour, smell, taste and appearance. In order to ascertain whether this standard is maintained, every creamery must subject to the reductase test at least once a week the milk delivered by each individual supplier.

If the milk from any supplier becomes discoloured after 20 minutes' test, the creamery, in paying for the milk in question, must deduct a sum to be decided in consultation with the committee of suppliers.

A register, approved by the Ministry, must be kept by every creamery in which must be entered the results of the reductase tests immediately after the tests have been carried out. Government inspectors, visiting creameries on other business, must see that this register is properly kept and, if not, must report the fact to the Ministry.

The Circular, which came into force on 1st April, 1931, has not been received with universal satisfaction in Denmark, and letters for and against the proposed scheme of compulsory reductase tests have been published in the dairying journals.

DANISH PIG CENSUS, 1931.

The Danish Statistics Department have published the results of the extraordinary census of pigs which was taken on 15th January, 1931. This was

what is known as a " representative " census, because returns were collected from only one-fifth of the parishes in Denmark. On the basis of these returns, the numbers of pigs were calculated. The grand total worked out at 5,232,000 head, an increase of 6.3%, for the country as a whole. All districts with a single exception, show some increase. The details of the census are as follows:—

		Jan., 1931.	July, 1930.
Boars, 4 months and upwards	... ...	27,182	24,309
Sows, 4 months old and upwards, in pig	. ...	389,517	394,615
Sows, 4 months old and upwards, not in pig	...	191,290	191,572
Store pigs, 4 months and upwards	... ...	1,189,713	1,020,148
Sucking pigs, 2-4 months ...	... ...	1,787,337	1,619,001
Sucking pigs, under 2 months	... ...	1,647,024	1,670,202
Total	...	5,232,063	4,919,847

The figures show a rise in the number of bonhams of 2 to 4 months old and also of store pigs. On the other hand, the numbers of sows in pig and of sucking pigs have fallen, which would appear to indicate that the expansive movement which had been observed in the pig-breeding industry had come to an end at the date of the census.

THE GERMAN POTATO-STARCH INDUSTRY.

The manufacture of potato-starch has been carried on for many years in Germany as a kind of agricultural side-line, particularly on the big estates in Prussia. Starch-making is regarded as an excellent way of utilising surplus stocks of potatoes, and even potatoes which are somewhat damaged can be used for the purpose. Only advanced decay and disease which damage the starch grains make potatoes unfit for starch-making. The majority of the factories make wet starch, the preparation of which is simpler and cheaper than that of dry starch, and therefore more suited to rural conditions.

The industry, which has been declining in Germany for some years, though it acquired some importance during the war, again attracted attention last year, when the potato crop was exceptionally heavy and there was much difficulty in disposing of surplus supplies. A Committee, which was appointed to consider the industry, reported that the number of factories in 1927 was about 200, but a good many of these are not now at work. The quantity of potatoes used for starch-making during the season 1927-28 was over 625,000 tons, rather less than one-half what it was in the last year before the war. The value of the total production of the factories in 1927-28 was estimated at about £2,500,000 and that of the raw material used at £1,500,000, exclusive of freight charges. Owing to the fact that the factories have not been working up to their full capacity, there has been a big increase in working costs, a serious matter in a seasonal industry. A characteristic feature of commercial starch-making is that it needs a large working capital, the return of which is slow. Large sums have to be laid out in the autumn for the purchase and delivery of potatoes, whereas the

sale of the manufactured products is distributed over the entire year. A serious competitor to the German potato-starch industry in recent years has been maize-starch, which is manufactured on a large scale at Barby, on the Elbe, by the Maizena Co., Ltd., who also control a large commercial potato-starch factory.

RESULTS OF COW-TESTING IN GERMANY.

German official statistics show that the average annual milk yield of cows in that country is only 488.4 gallons, a figure which is regarded as very unsatisfactory. In these returns, cows are divided into two groups: cows kept exclusively for dairy purposes and cows which have to do a certain amount of work as well. In the latter group, the average annual milk yield is only 350 gallons. Of the dairy cows proper, those whose milk is tested show an average yield of 764 gallons, whilst the others show an average of only 506 gallons.

Of the cows whose milk yield was not recorded, the average yield in 19 out of 40 administrative districts was less than 440 gallons. The lowest yield was 315.4 gallons, while in the same district the average for recorded cows was 551.5 gallons.

The cow-testing movement in Germany met at first with much opposition. The number of societies in 1914 was about 800, but the movement was completely crippled by the war. Of recent years, however, it has regained much ground, and the number of societies at the beginning of 1930 was 2,917, embracing 57,435 farms, and over a million cows. The proportion of recorded cows in Germany as a whole is 11 per cent.; in Prussia it is 15 per cent. In other parts of the country, the percentage varies widely.

It is reported that in every case, the establishment of a cow-testing association has resulted in an immediate increase in milk yield and as a rule there has been no increase in feeding costs.

SECOND-GRADE EGGS AND THEIR CAUSES.

The Danish Co-operative Egg Export Association have issued a circular to their members, setting forth the defects most usually met with in second grade eggs. These are as follows:—

Disease in the hen, e.g., inflammation of the oviduct, etc., may result in second-grade eggs.

Defects in Diet: fish, too much or too inferior offal, turnip leaves, etc., may also produce second-grade eggs.

Hatched eggs: Eggs which have lain under hens or in the incubator may be second-grade, or even worse.

Old eggs: Eggs which have been kept too long are second-grade eggs or worse.

Washed eggs are second-grade eggs, because eggs are spoilt by being placed in water and rapidly deteriorate.

Dirty, ink-smeared, over-stamped or spotted eggs are also of the second grade.

Egg collectors can see at a glance whether eggs are dirty or smeared or whether the stamp has been smudged, and often too whether the eggs have been washed or mixed.

The majority of the defects of second-grade eggs can be obviated by the members themselves, provided they exercise sufficient care.

Thick-shelled eggs:—A good commercial egg should have a sufficiently thick shell, as such an egg is stronger and more durable and weighty. Hens should receive plenty of crushed shell. The outlay on this is amply repaid by the increased value of the eggs.

Stamping:—Members should frequently inspect their stamps and renew them when required. It is very important that stamps should be clear and distinct, a condition which is demanded by the State Inspection Service.

DECENNIAL LIVE STOCK CENSUS IN HOLLAND.

A census of live stock is taken every ten years in the Netherlands. Returns were collected in 1930 between the dates 20th May and 20th June, and the final results have just been made public. The following table shows the totals for 1930 as compared with those returned on the two previous occasions, 1921 and 1910:

	1930.	1921.	1910.
Horses	299,152	363,668	327,377
Cattle	2,366,066	2,062,771	2,026,943
Sheep	484,987	668,211	889,036
Goats	131,252	272,298	224,231
Pigs	2,917,781	1,519,245	1,259,844
Fowl	24,637,204	9,660,799	9,777,962
Ducks	662,161	——	——
Beehives	86,326	93,637	69,406

The most remarkable increases are in the case of pigs, which have increased by half a million since the last census, and fowl, which number 24½ million as compared to 9½ million in 1921. The number of cattle has also risen, but that of sheep and goats shows a decline.

THE CO-OPERATIVE TRADING MOVEMENT IN HOLLAND.

There are in Holland about 400 co-operative trading societies, having some 65,000 members. These societies are affiliated to what is known as the Central Bureau. The following amounts of commodities were purchased by the members during the year 1929-30 :—

Nitrogenous manures	156,333	tons.
Basic slag	116,089	,,
Superphosphates	37,590	,,
Potash salts	140,569	,,
Maize	140,840	,,
Barley	40,022	,,
Oil-cake	66,407	,,
Fish meal	3,121	,,

The total turn-over, which amounted in 1900 to some £44,500, is to-day no less than £4,704,000.

THE POULTRY INDUSTRY IN SAORSTAT EIREANN— A DUTCH APPRECIATION.

One of the distinguished visitors whom we had the honour to entertain last year in connexion with the Irish tour organised by the International Poultry Congress was Dr. B. J. C. te Hennepe, delegate for the Netherlands, and European Secretary to the World's Poultry Science Association. Since his return to Holland, Dr. te Hennepe has published in a leading Dutch poultry journal an article entitled "A Visit to our Competitors in the Irish Free State." In this article he gives a charming description of his trip from Dublin to Cork and of his visit to the Munster Institute, and he seems to have taken away a very favourable impression of our poultry and of the efforts made by the State to develop and improve it.

Dr. te Hennepe was quick to note the characteristic features of the landscape of Ireland, the "Green Isle of Horses," as he calls it; its many rivers and fertile valleys, and the beautiful pastures where cattle and poultry are reared. He was also much interested in the ancient Round Towers, "those peculiar, mysterious, lonely giants of a former age." The great bogs, with their turf-stacks, remind him of Holland, and he notes with interest that there are "horses in the fields about every farm-house, instead of fowls, as with us."

Our visitor was evidently impressed by the useful work done by the Munster Institute in connexion with the training of poultry instructresses, and he recalls the fact that from the Institute "were organised the first breeding-stations, from which stud birds are sent out to the farmers, and this practice has spread from Ireland to other countries." He notes too that the persons who enter birds for the Egg-Laying Competitions are largely the owners of breeding-stations. This, he points out, "affords a splendid means of controlling the breeding-stations."

Apart from its practical side, Dr. te Hennepe was struck by the beauty of the Institute's surroundings, "and the climate which is nearly as mild as in the South of France on the Riviera, yields a luxuriant plant growth. The lanes and power beds around the old castle and between the poultry pens are," he continues, "full of flowers, particularly roses, and the 600 birds taking part in the egg-laying competition lived there as in a paradise."

Dr. te Hennepe further observes that the favourable conditions under which the competitions take place are reflected in the results achieved. Having given the averages for 48 weeks, he says: "For the hens in particular, these figures for 48 weeks are amazingly high, especially as we know that they only include eggs above the minimum weight which has been fixed. If all the eggs laid were included the number would be much higher."

Coming from such an authority as Dr. te Hennepe, such favourable comment is particularly gratifying, and it should serve to stimulate and encourage the efforts of all concerned in furthering the poultry industry in this country.

OFFICIAL DOCUMENTS.

Thirty-Eighth List.

AN ROINN TALMHAIOCHTA

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907, SECTIONS 8 AND 14 (1).

List of Names approved by the Department for use in connection with Margarine :—

L.L.
M.P.
P.M.
Silk-Spray.
Sungold.
Younoh.

Department of Agriculture,
Dublin, C.17.
31st December, 1930.

Thirty-Ninth List.

AN ROINN TALMHAIOCHTA

(Department of Agriculture).

BUTTER AND MARGARINE ACT, 1907, SECTIONS 8 AND 14 (1).

List of Names approved by the Department for use in connection with Margarine :—

Antler.
Davester.
Florio.
Nozon.
Sail.
Sentry.
Velmac.

Department of Agriculture,
Dublin, C.17.
30th June, 1931.

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